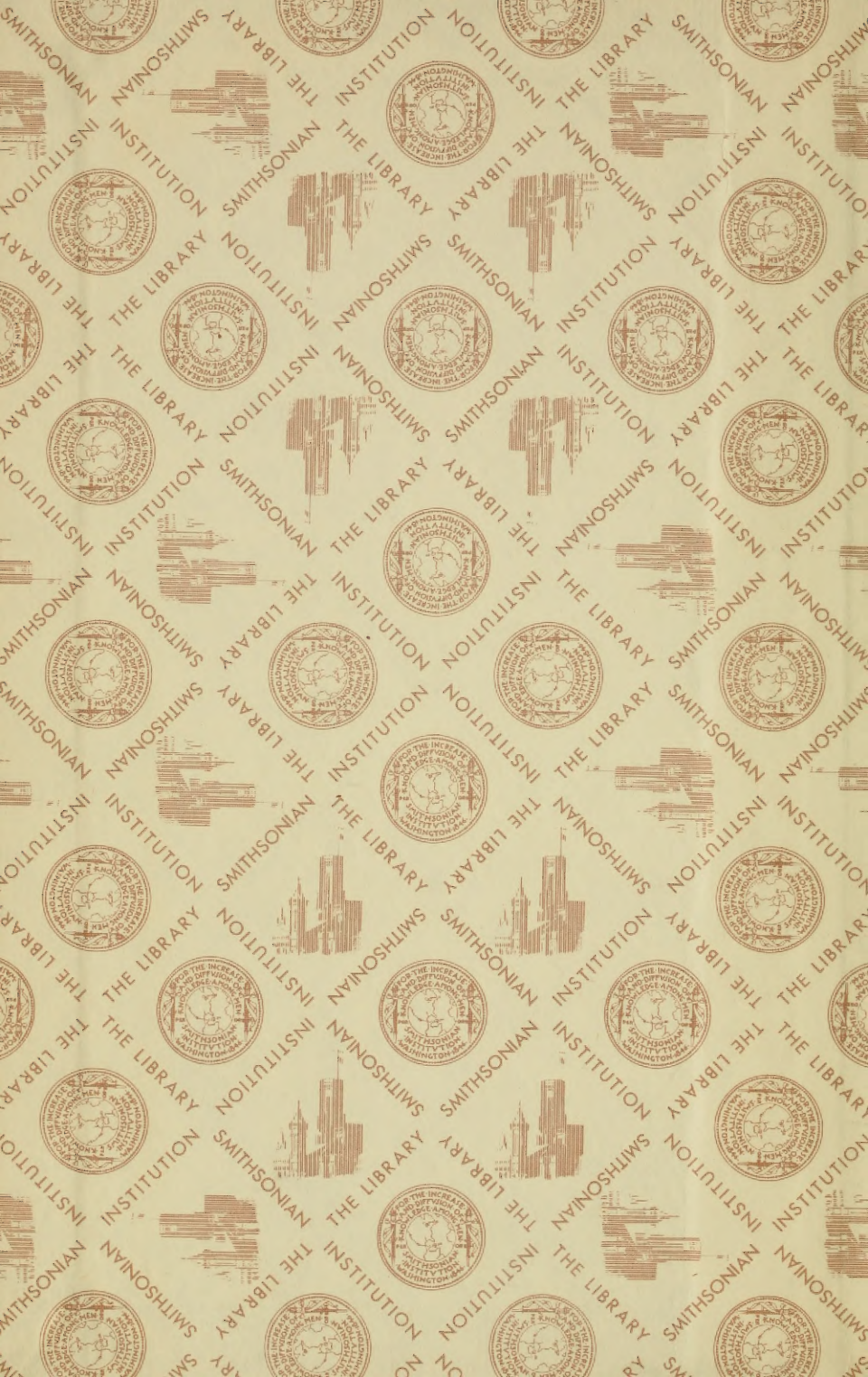
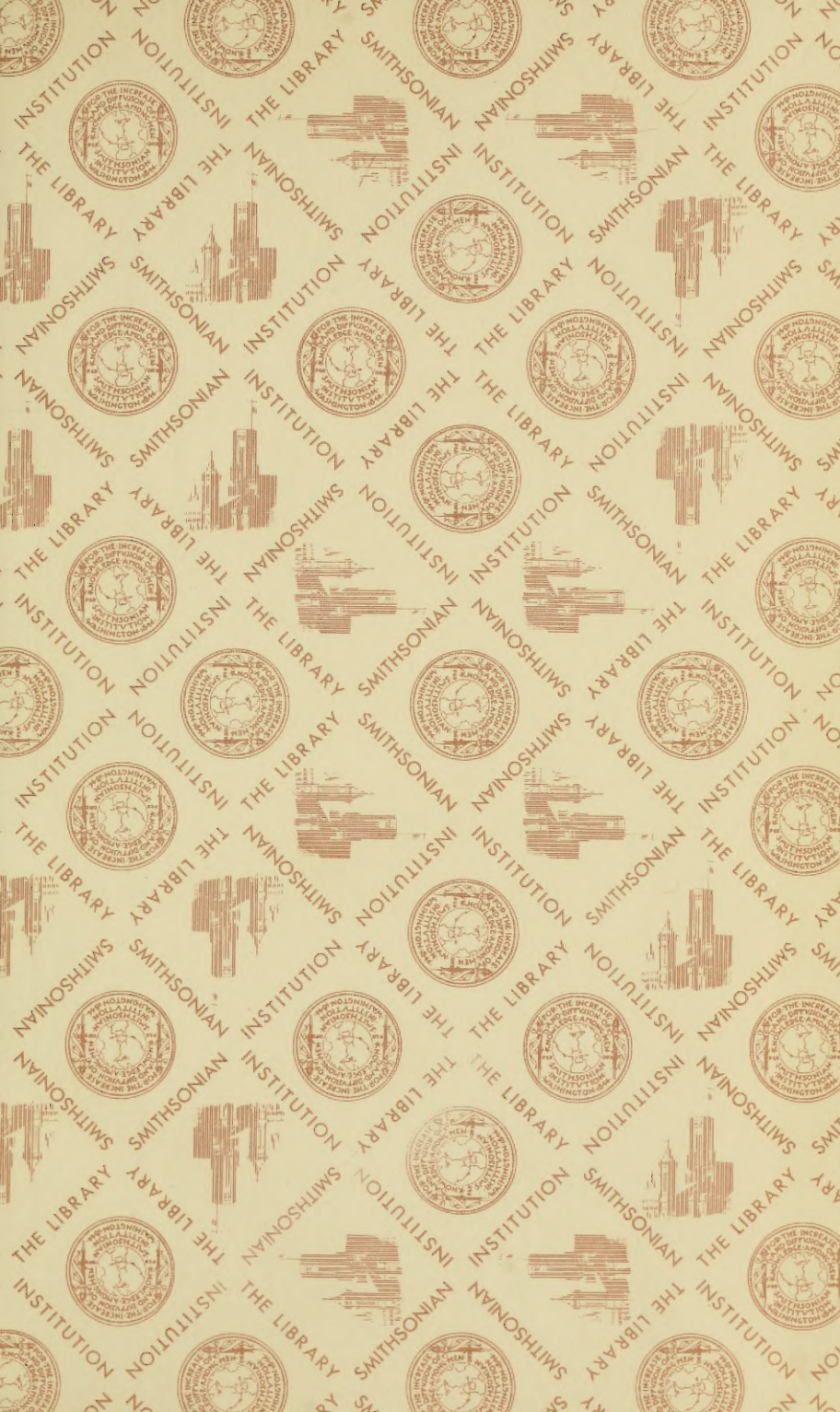










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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND
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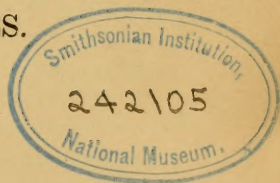
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AND

WILLIAM FRANCIS, Ph.D., F.L.S.

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VOL. IX.—THIRD SERIES.  
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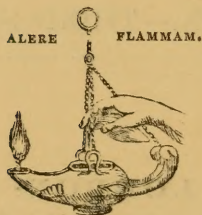
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“Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exulta; malè doctis et barbaris semper inimica fuit.”—**LINNÆUS.**

“Quel que soit le principe de la vie animale, il ne faut qu’ouvrir les yeux pour voir qu’elle est le chef-d’œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations.”—**BRUCKNER**, *Théorie du Système Animal*, Leyden, 1767.

. The sylvan powers
 Obey our summons; from their deepest dells
 The Dryads come, and throw their garlands wild
 And odorous branches at our feet; the Nymphs
 That press with nimble step the mountain thyme
 And purple heath-flower come not empty-handed,
 But scatter round ten thousand forms minute
 Of velvet moss or lichen, torn from rock
 Or rifted oak or cavern deep: the Naiads too
 Quit their loved native stream, from whose smooth face
 They crop the lily, and each sedge and rush
 That drinks the rippling tide: the frozen poles,
 Where peril waits the bold adventurer’s tread,
 The burning sands of Borneo and Cayenne,
 All, all to us unlock their secret stores
 And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.



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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

"..... per litora spargite muscum,
Naiades, et circum vitreos considite fontes :
Pollice virgineo teneros hic carpite flores :
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas ;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo."
N. Parthenii Giannettasii Ecl. 1.

No. 49. JANUARY 1862.

I.—*Observations on the Structure and Reproduction of Eleutheria*,
*Quatref.** By DR. A. KROHN†.

MR. HINCKS has recently communicated, in the 'Annals and Magazine of Natural History' (3 ser. vol. vii. p. 73), some exceedingly valuable observations on *Eleutheria*, which are of especial importance, because they finally solve the question which has hitherto remained in suspense, as to the origin and position of this remarkably beautiful Cœlenteran. For although Van Beneden and Dujardin had already raised many well-founded objections against the opinion of its discoverer (who associated *Eleutheria* with the *Hydrina*), recognized its relationship to the Medusæ, and conjectured that it originated from a Medusan or Hydroid polype, the latter still remained to be discovered‡. In this Hincks has succeeded. The parent stock on which *Eleutheria* is produced as a bud belongs, according to Hincks, to the family *Coryniadæ*, in which it represents a new genus and species—*Clavatella prolifera*.

* A. de Quatrefages, Mém. sur l'Eleuthérie dichotome, nouveau genre de Rayonné, voisin des Hydres. Annales des Sci. Nat. 2 sér. tome xviii. p. 270.

† Translated by W. S. Dallas, F.L.S., from Wiegmann's Archiv, 1861, p. 157.

‡ Van Beneden, Bull. Acad. Brux. 1844, tome ii. p. 305; Dujardin, Ann. Sci. Nat. 1843, 2 sér. tome xx. p. 370, and 1845, 3 sér. tome iv. p. 257.

In May of the present year, during the last two weeks of my stay in Nice, I had daily opportunities of examining *Eleutheria*. It occurs there exclusively upon a delicate confervoid Alga, close to the sea-shore, along that part which bears the name of Boulevard de l'Impératrice. It is to these observations that I am indebted for being enabled to fill up many gaps left in the memoirs of both my predecessors.

The *Eleutheria* which is to be met with at Nice agrees in all respects with that living on the Devonshire coast. As already indicated by Hincks, it is distinguished from the *E. dichotoma*, discovered near the Chausey Islands, by having only one of the two branches into which each of the six arms divides furnished with a button, abundantly beset with nematocysts; whilst in *E. dichotoma*, both branches of the arms are provided with a button (*pelote*) of this kind. In size, the *Eleutheria* found at Nice agrees with *E. dichotoma*, measuring, when the arms are fully extended, 1.25 to 1.50 mill., of which 0.50 mill. goes to the diameter of the body.

When a lively specimen of the *Eleutheria* is placed in a drop of sea water on the object-plate, and examined under a suitable magnifying power, it is seen immediately to move from the place by means of its arms. We are thus convinced that the progression is effected exclusively by the branches of the arms which are furnished at their extremities with a sucker-like disk, which now adhere to the support and then again quit their hold in variously alternating order. The knobbed branches of the arms are only seen curving to and fro. If, after a little time, the animal has attached itself by all its arms, and remains for a time in this condition, the branches furnished with an urticating button are seen to extend themselves horizontally outwards, above the attached branches on which the body rests as on so many feet, so that they now look like direct continuations of the main stems of the arms. The little animal then, to borrow a perfectly suitable comparison of Mr. Hincks, has the appearance of a very minute Star-fish. If it be now detached from the object-plate by means of needles, and turned over so that the buccal orifice is directed towards the observer, it endeavours to get out of this uncomfortable position, by bending the sucking-branch of one or more of the arms towards the supporting surface, in order to attach itself thereby. If it succeed in this, it soon contrives to turn itself over and thus regain its previous position.

Consequently, whether the *Eleutheria* creeps upon a horizontal plane, as in the case just cited, or, as in nature, upon the above-mentioned Alga, which ramifies in every direction, the surface of the body in which the mouth is pierced is always turned towards its support. This surface is therefore to be indicated as

the lower side (distal surface of Hincks), and the opposite and more strongly arched surface as the back (proximal surface of Hincks)*.

The direction in which the furcation of the arms takes place has been, if not overlooked, at least not indicated with sufficient emphasis by Mr. Hincks. On careful examination, we shall soon be convinced that the knobbed branch, on quitting the main stem, stretches in a more or less inclined direction upwards and outwards, and that furnished with the sucking-disk downwards; so that, when both come to stand in the same line, or, as is usually said, cover each other, the angle of divergence stands parallel or perpendicular to the axis of the body.

The mouth is often seen extending itself in the form of a cylindrical tube, remarkable for its white colour; and when this is the case, the otherwise only moderately convex lower surface of the body becomes more strongly inflated. This buccal tube, however, which is bent to and fro like a proboscis, not unfrequently changes its form, sometimes assuming that of a short, wide-mouthed funnel, or even becoming inflated into a spherical shape. In this respect, therefore, it resembles the buccal cone of the Hydroid polypes, to which, and no less to the so-called stomachal peduncle of the *Oceanidæ*, it likewise corresponds morphologically. When the tube is extended, however often it may change its form, the mouth is always open; when the tube is retracted, the mouth closes completely. By this arrangement, the animal is evidently enabled to pick its food, which consists partly of Diatomaceæ and partly of small Crustacea (*Copepoda*), from the branchlets of the Alga. With regard to the lower surface of the body, I will add here that its outer layer (ectoderm) contains numerous nematocysts, which are entirely wanting on the buccal tube and all other parts of the body, with the exception of the arms.

Mr. Hincks was unable to confirm Quatrefages' statements as to the structure of the eyes. They appeared to him to be mere aggregations of pigment, without any trace of refractive media. From my observations, I can only answer for the correctness of those statements up to the assumption of a cornea, the existence of which I must deny.

Even if we did not already know from Hincks that *Eleutheria* originates from a Hydroid polype, the demonstration of a gas-

* I cannot allow it to pass unnoticed that these descriptions are by no means in accordance with those of M. de Quatrefages. This naturalist states that he observed that a specimen of *E. dichotoma*, placed on a glass plate, always turned up the surface on which the mouth is situated, during progression. In accordance herewith, this surface is regarded as the upper one (or anterior), and the opposite as the lower (or posterior) surface.

tro-vascular system, which, according to my investigations, is no more wanting in it than in the umbrella-bearing Medusæ, would of itself suffice to remove every doubt as to its true nature and position. This system is indeed much less developed than in the Medusæ which lead a pelagic existence, but it nevertheless consists, in accordance with the type, of radiating canals, six in number, corresponding with the arms, and of an annular vessel placed in the periphery of the body. The entire system is to be regarded as a lacunar excavation of the inner body-stratum (endoderm), which appears yellowish white by direct light, and brownish yellow under the microscope*. The best mode of obtaining a general view of this system is to bring the focus first of all upon the dorsal surface of the body, and then gradually carry it deeper. It is then seen clearly that the six proportionally very wide but extremely short radiating canals spring from a sharply circumscribed discoid space occupying the bottom of the cavity of the body or stomach, from which they curve down along the radii corresponding with the arms, to open at last at the periphery of the body, into the perceptibly narrower annular vessel†. From the annular vessel a very narrow and therefore very difficultly detectible canal is given off for each of the arms; this, running down in the axis of the arm, divides at the point of bifurcation into two branches, one of which penetrates each branch of the arm and reaches to its extremity‡.

In the axial canals of the arms, currents of a fluid filled with granules (chyle) may frequently be detected. They are undoubtedly produced by the play of vibratile cilia, the effects of which may readily be recognized from the granules seen here and there in rotatory or oscillatory movement. But they are

* The *Eleutheria* is indebted for its yellowish-white colour to the endoderm shining through the outer transparent layer (ectoderm). This colour has its seat in numerous roundish corpuscles imbedded in the endoderm, consisting, as already mentioned by Quatrefages, of an accumulation of very small granules.

† The above-mentioned discoid space is in all probability a shallow excavation of the bottom of the stomach, and may correspond to the chyle-receptacle detected by Gegenbaur (*Grundzüge d. vergl. Anat.* pp. 82, 84, & 85) in several of the lower Medusæ (Craspedota).

‡ The arms of *Eleutheria* agree in structure with those of most Hydrozoa in their areolar or cellular tissue, the histological nature and physiological signification of which do not appear to have been yet satisfactorily ascertained. In *Eleutheria*, in which the axial canal extends through the midst of this tissue, the brown corpuscles already mentioned are seated on the compartments or cells immediately around the canal, although in very small quantity, from which we might be justified in regarding the entire tissue as a peculiar modification of the endoderm. I found it necessary to insert this remark here, because the views of M. Quatrefages as to the structure of the arms, which are also followed by Hincks, differ from mine in many particulars.

likewise evidently under the influence of the constantly changing state of contraction of the arms themselves, and undergo many deviations in consequence. In the other sections of the gastro-vascular system similar currents are scarcely to be distinguished, on account of the far closer approximation of the brown corpuscles already repeatedly mentioned. Still I saw them quite distinctly in many parts of the annular vessel*.

Eleutheria propagates partly by eggs, and partly by buds. The former of these modes of reproduction was observed by Quatrefages, and recently confirmed by Hincks. I shall notice it first.

The place of formation of the ova is the whole upper wall of the body-cavity, or the dorsal surface. Here, between the ecto- and endoderm, the ova are produced, and here they pass through all the stages of development up to the maturity of the embryos. The seat of the production of the ova is therefore at the same time the brood-chamber.

The youngest ova seen by me were met with in a not yet fully mature individual, which contained about thirty of them. The careful investigation of a few of them gave the following results:—Some appeared to be of a rounded, and others of a more oval form, but all were of the same size, which might be about $\frac{1}{15}$ mill. In the midst of the granular yelk, which appeared dead white by direct light, an accumulation of rather large, apparently solid corpuscles could be distinguished, intermixed with rather smaller spherical vesicles, which had the aspect of reddish-brown oil-drops. Each egg was surrounded by a delicate envelope (chorion), separated from the yelk by a small interval.

Of the segmentation of the yelk I have only seen two of the later phases,—namely, that known under the name of the mulberry-form, and one rather less advanced. In this latter stage the yelk was already divided into numerous globules of segmentation, but these were still comparatively large and marked off from each other by sharp and here and there polygonal boundary-lines. Each globule also appeared to contain the well-known central nucleus. All the eggs engaged in segmentation were considerably (almost two-thirds) larger than the egg-germs above described.

The embryos contained in the same parent animal are for the most part in dissimilar stages of development, which leads to the conclusion that the ova are successively produced. Hence as the number of embryos increases, and as the period of their

* Although I found it impossible to demonstrate the presence of cilia in the gastro-vascular system, I recognized them most distinctly on the inner wall of the body-cavity. Here they appear as extremely fine and comparatively long filaments, which, however, are much scattered.

maturity approaches, the more strongly does the dorsal surface of the parent become inflated, the ectoderm being continually removed further from the endoderm. When the embryos are so far developed that the period of their escape approaches, the dorsal surface appears elevated into a corresponding number of roundish humps. At last these humps of the ectoderm burst one by one, and thus the young are set free in a corresponding order*.

The male of *Eleutheria* appears to be very rare. I only had the opportunity of observing it once. Like the eggs in the female, the semen in the male is produced in the back, between the ectoderm and endoderm. In the male alluded to, the back appeared to be much distended by a considerable quantity of the semen, which shone through the ectoderm as a chalky white mass. Minute floccules of this perfectly mature semen, artificially set free by tearing the ectoderm, proved to be composed of thousands of remarkably active spermatozoa, characterized by a bacilliform head, and a long tail running out into a fine point at the extremity.

I now come to speak of the second mode of reproduction, namely that by gemmæ. This occurs not only in the asexual individuals, but also—which is worthy of notice—in those which are sexually perfectly developed. Thus most of the females which came under my observation, small as their number might be in comparison with the great quantity of asexual individuals, bore more or less developed buds; and this was the case also with the male above mentioned†.

The bud appears at first in the form of a small, rounded excrescence upon the back of the parent animal, close to the periphery of the body, in one of the interbrachial or interradiar spaces. At its earliest origin it is nothing but a diverticulum of the annular vessel, which during its increase has pushed the ectoderm before it, and raised it into a mound. It consequently consists of two superposed layers (the ectoderm and endoderm) and of a cavity communicating with the gastro-vascular system.

* From this there seems to be no doubt that the creature met with by Hincks in the somatic cavity of one individual, and regarded by him as a free embryo, which, after repeated endeavours to get out, always returned again into the cavity, is to be considered only as an animal (probably a Copepod) which had either got accidentally into the stomach or had been swallowed.

† My investigations, as already stated, were made in the first half of May. It appears from the observations of Quatrefages that at other seasons the formation of buds entirely gives place to sexual reproduction. This naturalist says expressly that he did not detect the slightest indication of buds on specimens of *E. dichotoma* observed during the summer months; so that their increase during this period is probably effected exclusively by eggs.

In the course of its development the excrescence acquires a hemispherical form, its base, which is still affixed broadly to the parent animal, becoming gradually more and more narrowed or constricted, whilst the distal extremity, or that turned from the parent, becomes widened and flattened. On the periphery of this distal surface six rounded processes are soon seen to rise at equal distances apart, during which the endoderm bounding the cavity of the bud is drawn out into a corresponding number of diverticula. These processes, as may easily be supposed, are the first traces of the future arms.

When the above-mentioned processes have become developed into the stems of the arms, the branches soon make their appearance. The extremity of one branch, namely that which will subsequently be the upper one, gradually dilates, becomes furnished with a constantly increasing number of nematocysts, and is thus converted into the urticating knob. In this stage the areolar tissue which is afterwards acquired by the arms is scarcely indicated. The endoderm of the arms, containing an abundance of the brown corpuscles, is closely applied to the ectoderm, and the axial canals are still considerably wider than in the fully developed animal. The bud adheres to the parent animal by a short stalk issuing from the vertex of the arched surface (the future dorsal surface).

During the maturation of the bud to its future form, the ocelli make their appearance close above the origin of the arms; and subsequently the mouth, which was previously wanting, also appears. In the arms the areolar structure may now be much more distinctly recognized; but the endoderm, although laterally removed from the ectoderm and compressed towards the axis of the arms, still retains its previous intense-brown colour.

A little before maturity the impulse to independent movements awakens in the bud. We may then see how it continually bends the arms to and fro, and even endeavours to adhere by them to the nearest objects. When the period for its separation from the parent arrives, it falls off, with the adherent peduncle, after which the latter is rapidly shortened and finally vanishes. The diameter of the body of the bud when set free may be estimated at $\frac{1}{4}$ mill.; so that it has to become twice as large to attain its definitive size*.

The formation of buds commences at a very early period of life, at a time when the young *Eleutheria* is still connected with its parent as a bud. A little before the separation of the bud the first gemma may already be seen sprouting forth in one of the

* If the above description of the gemmation be compared with that of Hincks, who was so fortunate as to observe it upon the polype-stock, the mutual agreement in regard to essential points will not be overlooked.

interradial spaces. When the bud has become free, the number of gemmæ increases with its advance in growth, but so that only a single gemma is produced in each of the other five interradial spaces. In rare cases a seventh gemma occurs; this usually appears to break forth close beneath one which is already far advanced in its development.

Thus the gemmæ, when their number amounts to six—which I observed only in asexual individuals, and then but seldom—alternate very regularly with the arms, and present very different grades of development, according to the time at which they appeared.

In concluding the present memoir, I can boldly assert that *Eleutheria* belongs to the Medusæ. In support of this opinion, which was accepted by many modern naturalists even before the discovery of the parent polype, I have brought forward further proofs, of which the discovery of the gastro-vascular system, the information as to the sexually-produced brood, by which a sensible gap in the developmental history of the parent polype is filled up, and the evidence of a gemmiparous reproduction, issuing originally from the gastro-vascular system, may be particularly indicated as important*.

It is true that *Eleutheria* differs from the other Medusæ, in no small degree, by the absence of an organ of propulsion or umbrella; but this deficiency stands, as no one will deny, in the fullest accordance with its mode of life.

Nevertheless, by the aid of the imagination, *Eleutheria* may be converted into a convex Medusa. We need only imagine

* To my knowledge, only one Medusa is as yet known which, like *Eleutheria*, gives off buds in the mature sexual state. This is *Sarsia prolifera*, Forbes (see Busch, 'Beobachtungun über Anat. und Entw. einiger nied. Seethiere,' p. 7). As another example of this kind, I believe, I must cite *Geryonia proboscidalis*, in accordance with an observation made many years ago. During my sojourn in Messina, in the year 1843, I met with a female specimen of this Medusa, in which the ends of the peduncle, reaching freely down into the stomachal cavity as in *Liriope*, appeared thickly beset with buds in various stages of development. The less developed buds occupied the upper, and the more advanced ones the lower part of the peduncle. In the former only the umbrella and peduncle could be distinguished; the latter had evolved not only the six tentacles, but also the marginal corpuscles. All these buds adhered firmly to the peduncle of the parent by the vertical point of their umbrella. Surprising as it may be to see buds sprout forth in the interior of an organ which is destined at the same time for the reception and digestion of nourishment, it must not be forgotten that the same phenomenon has already been observed in another Medusa. This is *Egineta prolifera*, Gegenb. ('Verhandl. d. phys.-med. Gesellsch. in Würzburg,' Bd. iv. p. 209). On the whole, however, reproduction by buds appears to be but little diffused amongst the Medusæ, and, from what has been said above, to be generally limited to the young states.

the body dilated from the periphery and bent round into the form of an umbrella or bell, without implicating the stomachal cavity in the change. The stomachal cavity then remains, somewhat as in the *Occanida*, limited to the centre of the umbrella thus produced. The arms, with the ocelli and the annular vessel, on the contrary, advance by the whole length of the radii of the umbrella from their previous position, with which, of course, is associated a corresponding elongation of the radial canals.

In conclusion, as regards the relationship of *Eleutheria* to the established Medusoid genera, it has recently been placed by Gegenbaur, and as it appears to me with perfect justice, in the vicinity of the genus *Cladonema*, Duj. (*Zeitschr. für wiss. Zool.* Bd. viii. p. 230). In fact, both in structure and mode of life there appear to be many remarkable agreements between the two. In connexion with the first point, we must cite first of all the dichotomous division of the arms, which is certainly carried further in *Cladonema* during the development on the parent polype-stock (*Stauridium*), but still agrees perfectly with that occurring in *Eleutheria**, and secondly the comparatively high organization of the ocelli. As regards the second point, we know already from the observations of Dujardin that *Cladonema* sometimes, like *Eleutheria*, fixes itself by its arms, and remains for a considerable time in this state of repose. In the harbour of Messina, where this Medusa not unfrequently occurs, it lives chiefly, according to my observations, upon a confervoid Alga, which covers the sea-bottom in abundance, and it appears to come but rarely to the surface of the sea.

II.—On Hanburia, a Cucurbitaceous Genus from Mexico.

By BERTHOLD SEEMANN, Ph.D., F.L.S.

IN August 1854, Mr. William Schaffner found near Cordova, in the "Sierra caliente" of Mexico, a Cucurbitaceous plant with a fruit resembling in outward appearance the well-known "Chayote" or "Chayotl" of the Mexicans (*Sechium edule*, Jacq.), and bearing, on account of that resemblance, the vernacular name of "Chayotilla." A few seeds of it, which he transmitted, were, together with a collection of dried plants, purchased by the Royal Botanic Gardens at Kew; they were planted, but did not germinate. These seeds were flat, nearly orbicular in circumference, and about 2 inches long, having a very thin mem-

* Dujardin, *l.c.* 1843, tome xx. p. 372. According to Keferstein and Ehlers ('*Zool. Beitr.*' 1861, p. 86), no more indication of a further ramification is to be detected in the arms of free young *Cladonemata*, measuring 0·8 mill. across the umbrella, than in *Eleutheria*.

branaceous epidermis, and resembling altogether so much those of *Fevillea* that I suggested they might possibly belong to that genus. Mr. Schaffner, on being informed of this suggestion, replied that he could not agree with me, as the complete specimens at his disposal enabled him to pronounce the *Chayotilla* a representative of a new and remarkable genus, differing from *Fevillea* by its setose-echinate fruit, and other characters. In order to convince me, he enclosed in a letter to our friend Mr. Scheer, of Northfleet, a fragment of the plant in question, afterwards presented by me to Sir W. J. Hooker's herbarium. This fragment, of which Mr. Fitch made a characteristic drawing, shortly to be published in the '*Bonplandia*,' was carefully examined and compared with all the Cucurbitaceæ in Sir William J. Hooker's and other large herbaria; but neither there nor in any published description or figure did I find any type approaching that of Schaffner's remarkable plant. I therefore assumed it to be quite a new genus, and seized the opportunity of conferring upon it, in honour of my esteemed friend Daniel Hanbury, Esq., F.L.S., the name of "*Hanburia*," in a paper read, July 1, 1858, before the Linnean Society, and published, on the 15th of August of the same year, in the '*Bonplandia*' (vol. vi. p. 293). Owing to the imperfect materials at my disposal, the generic character I was able to furnish remained in several particulars incomplete. This defect I am now able to remedy in some measure; for, shortly after the publication of my paper, two drawings, accompanied by a fair account of the plant, and addressed, as far back as 1850, by M. Hugo Fink, of Cordova, Mexico, to Sir William J. Hooker, were found at Kew, and kindly placed by Sir William at my disposal. M. Fink, avowing himself a self-taught botanist, and claiming indulgence if he should have used any unbotanical expressions, furnishes the following account, of which I have given an abstract in '*Bonplandia*' (vii. p. 2):—

"A perennial plant; roots not yet examined. Stem pentagonal, solid and very fibrous, tough (so that probably ropes might be manufactured from its fibres); climbing by means of tendrils to the height of from 60 to 80 feet, covering entire trees. As soon as the plant has attained the summit of a tree, the branches grow downwards, exactly as in *Vanilla* or *Begonia scandens*. Leaves cordate, smooth and glossy, on a long petiole, turning different ways. Flowers white, axillary and terminal, bell-shaped; corolla five-parted; calyx in five divisions, covering half the tube of the corolla, and terminating at each intersection of the corolla in a very small tooth. Stamens united in a hollow tube, terminating in a pentagonal, solid, almost round ball, having the form of the clapper of a bell. This ball, forming the anthers, is divided into five divisions, each of which

is divided into three double longitudinal lines bearing pollen; the latter is covered by a brittle tegument opening lengthwise. Flowers male and female. (On more than twenty occasions that I have been to the place where these plants grow, I have never met with a female flower: male flowers are very abundant at all seasons. I was already despairing of finding one, when last week I discovered several ripe fruits at the point of opening, five or six of which I took home for further examination. As yet, I have not been able to meet with a female flower, but shall do all in my power to obtain one.) Fruit oval, pointed at the apex, and crowned by the scar of the calyx (or corolla?), covered with numerous spines from 1 to 2 inches long. Ovary adherent, solitary, four-celled; ovules solitary, attached to a placentation formed by a column terminating in four claws like those of an animal, to each of which at its point an ovule is attached, one or two of which seldom arrive at maturity*. Seeds flat; testa horny; internal membrane thin, elastic, and veined; perisperm very abundant, bitter and purgative when raw, but having the taste of a walnut when cooked; embryo very small, flat; cotyledons foliaceous, mucilaginous; radicle straight, turned towards the hilum: the embryonary sac disappears in ripe seeds.

"Parts of the plant which are not exposed to the whole force of the sun ripen no fruit. From the fleshy part of the epicarp exudes a very transparent gum, clear as glass. The mesocarp of the fruit is composed of a network of numerous fibres, of a white colour, crossing each other in all directions. The plant is only found in the mountains of Mactlactleahuatl, or in places contiguous to them. It flowers all the year round; but only towards the end of August and September ripe fruits are found.

"The squirrels eat the kernels greedily; but as the fruit is very spiny, they cannot attack it; however, being acquainted with its mode of opening, five or six of them are in waiting every morning, and as soon as a fruit bursts, hasten to devour the seeds. As soon as the rays of the sun reach a ripe fruit, it will open, but not before. The shock is so strong, that the fruit is severed from the stalk and thrown heavily to the ground, while the seeds are dispersed in different directions.

"Most curious is the manner in which the fruit opens. Towards seven o'clock in the morning, on a sunny day, the fruit splits from *a* to *b* (fig. 3 of the accompanying drawing), then from *b* to *c*, from *c* to *d*, from *d* to *e*; when the opening has attained the point *e*, the fruit turns the piece *A* completely round, forces the column composing the claws in a reclining position, at the same time throwing the seeds with great force several yards' distance. The sections *b f*, *c f*, *d f*, and *e f* open afterwards slowly. The first part of the process lasts about half a minute, and the latter one minute.

"HUGO FINK."

"Hacienda San Francisco, near Cordova,
Sept. 10, 1850."

* "Since then, I have remarked that in some fruit all the four ovules ripen; but generally one is abortive, as shown in fig. 2 *c*.—II. F."

The chief characters of *Hanburia* are its campanulate corolla, monadelphous stamens, longitudinally arranged anthers, peltate stigma borne on an elongated style, solitary pendulous ovules, and setoso-echinate fruit bursting open when fully ripe, like that of *Momordica*. In its monadelphous stamens and setoso-echinate fruit it approaches *Cyclanthera*; but the corolla of that genus is hemispherical, the anthers are arranged transversely, the stigma is sessile, and the ovules are horizontal and indefinite. In its definite ovules and shape of the seed it exhibits some relationship to *Fevillea*; but the fruit of that genus does not burst open, nor is it covered with spines. In any new arrangement of the genera of Cucurbitaceæ, *Hanburia* will probable form the type of a distinct tribe.

HANBURIA, Seem., in 'Bonplandia,' vol. vi. p. 293 (1858),
et 'Bonplandia,' vol. vii. p. 2 (1859).

Char. gen. emend.—*Flores* monoici. *Masc. Calyx* campanulatus, 5-dentatus. *Corolla* campanulata, calyci adnatim inserta, 5-fida, lobis triangularibus acutis. *Staminum* columna elongata in discum peltatum orbicularem margine antheriferum desinens; *antheræ* longitudinaliter adnatæ. *Fœm. Calyx* tubo oblongo cum ovario connato, limbo 5-partito. *Corolla* maris. *Ovarium* inferum, 4-loculare, loculis 1-ovulatis. *Ovula* pendula axi centrali adnata. *Stylus* elongatus. *Stigma* peltatum. *Bacca* ovata, pulposâ, setoso-echinata, maturitate elasticæ irregulariter rupta. *Semina* pauca, plana, suborbiculata, margine incrassato cineta. *Embryonis* exalbuminosi cotyledones foliaceæ. Herba Mexicana, glabra, rhizomate perennante, caule 5-angulato, foliis longe petiolatis cordatis acuminatis integerrimis, cirrhis simplicibus spiraliter tortis, floribus axillaribus v. terminalibus pedunculatis albis, masculis racemosis, fœmineis solitariis.

Species unica:—

Hanburia mexicana, Seem., in 'Bonplandia,' vol. vi. p. 293 (1858),
et 'Bonplandia,' vol. vii. p. 2 (1859).

Nomen vernaculum Mexicanum "Chayotilla."

Prope Cordova, reipubl. Mexican. (W. Schaffner!).

22 Canonbury Square, London, N.

Nov. 21, 1861.

III.—On the *Anatomy of Sacculina*, with a *Description of the Species*. By JOHN ANDERSON, M.D.*

[Plate I.]

THREE years ago, I drew the attention of this Society to the fact of the frequent occurrence of *Sacculina* and *Peltogaster* on some

* Read before the Royal Physical Society of Edinburgh, Nov. 27, 1861

of the Crustacea of the Firth of Forth. For some years past the subject of the affinities of these parasites has been occupying the minds of many foreign observers; and the following observations, therefore, are brought before the Society in the hope that they may tend to throw some light upon this difficult question. In the present paper I have purposely abstained, as far as possible, from dogmatizing regarding their systematic position, but elsewhere I have referred them to the Cirripedes*. I may mention that the relative position of the investing sacs, the character of the ovaries and the ovigerous lamellæ, and the apparent hermaphrodite nature of the adult animal, when viewed in connexion with the larval form, appear to me clearly to indicate their Cirripedian nature. Accordingly, in my graduation thesis, I created a new order (Sacculinacea) for their reception†.

Among recent observers, Leuckart drew the attention of naturalists to Thompson's systematic description of *Sacculina*, and proposed the adoption of his generic term. "If we restore," he says, "the name *Sacculina* either for *Peltogaster* in Rathke's sense, or, at least, for the form characterized by Diesing as *Pachybdella*, we are only discharging an old, superannuated debt." In the same article he described a new form parasitic upon *Hyas araneus*, and which he named *Sacculina inflata*. In accordance with Leuckart's proposal, I use the term *Sacculina* as referring to the parasite alluded to by Cavolini, and as synonymous with *Peltogaster carcini*, Rathke, and *Pachybdella Rathkei*, Diesing.

The Larva. Pl. I. fig. 1.

The larva, in the first stage, is oval, and presents no marks of segmentation. Placed near the centre of the anterior margin of the body is a yellow speck—the eye (*a*). The ocellus is placed nearly in the centre of a dark-coloured ring (*b*). Krohn, who has observed a structure similar to this in the larva of a Balanide, regards it as the œsophageal ring. The lateral margins of the body, on either side of the ocellus, are prolonged into two horns (*c*); and in this respect the young resembles the Cirripedian larva in its first stage. It is provided with three pairs of natatory legs: the first pair (*d*) are situated immediately posterior to the horns of the carapace; they are uniramous, are provided at their extremities with bristles, and appear to be

* Graduation thesis, 'Contributions to Zoology.'

† The following are the characters of this order, as given in my thesis:—*Cirripedia sine segmentis, oculis et appendiculis. Carapax sacciformis et appendiculata est: foramen in carapace situm est. Pedunculus annulo corneo affixus est. Os suatorium. Larva primo monocula cum 3 crurum paribus. Cirripedia parasitica sub abdomine Crustaceorum Decapodorum Brachyurorum.*

composed of two joints: the second and third pairs (d' d'') are larger than the first, and are both biramous. The rami are furnished with bristles. The under surface of the body is prolonged into two spines (e e), which project beyond the posterior margin of the carapace. Besides these terminal spines, I have observed, through the transparent body, two other structures (f f), which resemble very much the middle pair of spines described by Darwin as occurring on the larva of *Chthamalus stellatus*. The greater portion of the body is occupied by an oval mass of nearly spherical globules (g). The various transformations of the larva remain yet to be determined.

The Adult Animal. Pl. I. figs. 10, 11, 12, 15.

According to the present state of our knowledge, this parasite seems to be peculiar to the Decapod Crustacea. All the specimens I have obtained have been attached over the terminal portion of the intestinal canal (figs. 10 & 11 b') of the crabs on which they were parasitic, the females of which they appear to infest more than the males. This latter circumstance seems to be owing to the large size of the purse of the female, as compared with that of the male crab, affording them a better protection and means of support.

The external sac (figs. 2, 4 a).—The external skin is a tough, brownish-coloured, corrugated, and highly contractile structure. It is chiefly by means of this membrane that the parasite is attached to the crab on which it lives. The part which is attached to the crab forms a short peduncle (b), but afterwards it suddenly expands to form the external sac. The pedunculated portion (b) is very firmly connected by means of a horny ring (d) to the skin which invests the gut of the crab. The posterior extremity of the sac remains open, forming a small orifice (c), which I have called ovario-branchial.

The peduncle (b).—The external skin of this structure is a continuation of the external sac (a), and contains within it a prolongation of the parasite (k), which passes through the horny ring, and rests upon the intestine of the crab. The prolonged portion is tubular. In this arrangement we have evidence for the parasitic nature of *Sacculina*, and are entitled to regard the anterior portion of the peduncle as the mouth. The mouth, structurally as such, is entirely absent; and the only way the animal appears to derive its nourishment is by this process absorbing the required nutriment.

The ovario-branchial orifice (c) is so named from the twofold function it is supposed to fulfil in the economy of the parasite. If a living *Sacculina* is carefully watched for a few minutes, this orifice will be seen to open and contract slowly, while a current

of water may be seen to pass into and out of the cavity of the body, the sac at the same time alternately distending and contracting. The ova, when fully developed, are extruded by this orifice, the structure of which confines the water to the sac which contains them. The orifice is situated upon the posterior margin of the body, and is slightly raised above the level of the sac. There is a constriction at its base, and a thickened portion of the sac plays the part of a sphincter muscle. The inner margin of the orifice is thrown into folds, usually eleven in number, sometimes of a delicate and pellucid appearance. By this arrangement the orifice is capable of great distention.

The corium (fig. 2 *e*).—On reflexion of the external skin we expose the underlying corium, which invests nearly the whole inner surface of the sac. I have succeeded, in one or two instances, in separating this membrane into two well-marked layers. The external layer is a very thin membrane investing the whole inner surface of the sac, attached at its anterior extremity to the horny ring of the peduncle, and posteriorly to the ovario-branchial orifice. I think it probable, when the external skin is moulted, that its place is supplied by this structure. The inner layer, following it from the ovario-branchial orifice to which it is attached, passes forwards, closely applied to the outer layer, till it nearly reaches the anterior margin of the sac, where it becomes reflected on to the anterior portion of the peduncle, and can be traced no further as a separate structure. At the left margin of the peduncle the corium is attached by a septum (fig. 3 *g*) to a pulpy body embraced in the folds of the ovigerous lamellæ.

Organs of reproduction.—On opening *Sacculina* by an incision extending through the sac and continued from the ovario-branchial orifice to the peduncle, we expose a pellucid sac (fig. 4 *i*) filled with ova. This sac is found on both sides of the pulpy body above referred to (fig. 2 *h*), which it embraces within its folds. The sac is merely a temporary structure including the ova till their full development; and at this period I have seen the ovario-branchial orifice plugged up by the extruded sac and its contents, and in other cases I have found it lying quite loose in the general cavity of the parasite. In specimens like these, a delicate membrane may be separated, by gentle manipulation, from the inner surface of the corium and from the surface of the pulpy body or internal ovaries. This membrane appears to be an ovigerous sac, in the process of growth, destined to receive a brood of ova, but, after their development, to be cast off like its predecessor (fig. 5). The ovigerous sac appears to be continually present in one stage or another of its development; so that the water which passes in at the ovario-branchial orifice is never in

contact with any other structure. In a large specimen of *Sacculina carcini*, I found two small mussels living in and attached to the inner surface of its ovigerous sac. The ova (fig. 6) are enclosed in the sac, and are arranged in a racemose manner, enveloped in a very delicate membrane.

The *internal ovaries* (figs. 2, 3, & 3', *h*), are situated posteriorly to the peduncle. They constitute an oval, flattened, pulpy mass, dividing the cavity of the parasite into two compartments; they are attached by the centre of their posterior margin to the left wall of the ovario-branchial orifice; and also, as previously mentioned, by the septum which runs along the left side of the sac they are connected to the corium (fig. 2 *g*). In the many specimens examined, I have always found a small tubercle (figs. 2 & 3 *o*), with a minute and apparently horny speck on its summit, placed on both surfaces (figs. 3 & 3', *o*) of the body of the ovaries lying opposite to one another, a little to the left of the centre of its posterior margin. On removing the little speck of horny matter, a depression is seen in the centre of the tubercle, apparently communicating with the substance of the ovaries. May not these structures be the orifices of the oviducts, closed by a temporary secretion of horny matter till the brood of ova in the ovigerous sac has attained its full development? This view of the nature of these tubercles has suggested itself to me from the difficulty of accounting for the passage of the ova into the ovigerous sac. The fact that the ova found on the external surface of the ovaries are always more fully developed than those further removed from the surface suggests another view of the subject—viz. that they are developed in successive layers, and thus constitute the ovigerous lamellæ.

Situated immediately posterior to the peduncle, is a well-defined cavity, lined by a special membrane, and containing two oval-shaped bodies (*b*) placed side by side. These pellucid sacs (figs. 7 & 8) contain in their cavities peculiarly shaped bodies (*c*), and are provided with convoluted ducts (*a*). The ducts appear to pass towards the right side of the parasite (figs. 3 & 3', *h*) along the anterior margin of the ovaries, where they unite and become lost. From the close relation of their ducts to the ovaries, it has all along appeared to me that these vesicles probably play an important part in the generative economy of the animal. This opinion seems to be strengthened by the fact that, on one occasion, when examining under the microscope a portion of the ovaries in the immediate neighbourhood of the vesicles, I detected among their convolutions a tube identical in appearance with the structure of their ducts. As yet, I have found it impossible, from the soft nature of the tissues of these parasites, to trace the ducts to their final termination; but, from the appearance of the

tube above described, it seems to me very probable that they terminate in the ovaries. The walls of the vesicles are simply granular. A peculiarly formed body (figs. 7 & 8 c) is placed in the interior of each of the vesicles, immediately over the opening of their ducts. The portion of this body situated immediately over the ducts (*b*) is of a brown colour, and apparently of a horny consistence, and is terminated by three processes. The whole structure (fig. 9) is extruded when pressure is applied to the vesicle. May not these vesicles represent the testes and cement-glands of these parasites?

These observations have been made from dissections of a new species, parasitic upon *Cancer pagurus*: it differs in its anatomy from *Sacculina carcini* in the form and position of the vesicles. In the former species, these organs are oval, and placed immediately posterior to the peduncle, while in the latter they are elongated (fig. 16), and buried in the left anterior angle of the ovaries.

The relation of the septum to the surrounding structures, and the double nature of the ovigerous sac, hypothetical oviducts and testes, indicate a tendency to bilateral symmetry.

Genus SACCULINA, Thompson.

Sacculina carcini, Thoms. Pl. I. figs. 10 & 12.

(Thompson, J. V., Entomol. Mag. vol. iii. 1836, pp. 452–456.)

Peltogaster carcini, Rathke, Beiträge zur Fauna Norwegens, Acta Leop. xx. p. 247, tab. 12. figs. 18, 19.

Pachybdella Rathkei, Diesing, Syst. Helm. i. p. 435.

Diagnosis.—Bilobata est, maxima diametro per transversum; parasitica in *Carcino mænade*.

This species is confined to *Carcinus mænas*, and, in my own experience, is almost always found on the female crab. It is bilobular in form, its greatest diameter being in the transverse direction. The figure given by Cavolini of the parasite he described exactly corresponds with this species. It varies greatly in size, and is undoubtedly the largest known species of these parasites. Some of my specimens are an inch in breadth. The skin, in the generality of specimens, is of a brownish-yellow colour, and is minutely corrugated.

This species has a wide geographical range. Cavolini obtained his specimens from the shores of the Mediterranean; Rathke first met with it in the Crimea, and afterwards in Norway; Schmidt found it in great abundance at Wangerooze, and he also obtained specimens on the Dalmatian coast; Steenstrup's specimens were from the Mediterranean and from the "Black Banks" in the North Sea. From the observations of Thompson,

this parasite appears to be of frequent occurrence on the Irish coast. Some years ago, I found this species for the first time in the Firth of Forth, but not nearly in such numbers as the following one.

Sacculina triangularis, n. sp., figs. 4, 11, 14.

Diagnosis.—*Triangularis* est, gregaria, raro sola; maxima diametro ab pedunculo ad posterius foramen pertinente: parasitus *Cancer paguri*.

This species is usually gregarious: sometimes as many as five individuals may be found huddled together and struggling for existence. I have never found it on any other crab than *Cancer pagurus*. Of the two species of these parasites found in the Firth of Forth, this is by far the most common: in some localities, along the coast, to find a crab free from it is the exception.

The form of the animal is triangular. The greatest diameter is in the longitudinal direction, *i. e.* from its attachment to the posterior orifice. Besides differing in its external characters from *Sacculina carcini*, it also differs from it, as already noticed, in the form and position of the vesicles.

I am indebted to Prof. Goodsir for a specimen of this parasite found in the collection of his lamented brother, the late H. D. S. Goodsir. It is a large specimen, apparently distended with ova, and adhering to the purse of a *Cancer pagurus*.

Sacculina inflata, Leuckart, fig. 15 (Wiegmann's Archiv, 1859, p. 232.)

Diagnosis.—Dorsi et ventris superficies multum arcuata est; posteriore foramine a corporis margine aliquantum remoto: parasitica in *Hyade araneo*.

I only know of this species through the description given of it by its discoverer.

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EXPLANATION OF PLATE I.

- Fig. 1. Larva of *Sacculina*; first stage: *a*, eye; *b*, œsophageal ring?; *c*, horns of carapace; *d*, first pair of feet; *d'*, second pair of feet; *d''*, third pair of feet; *e*, terminal spines; *f*, supposed anterior spines; *g*, central cellular mass of the body.
- Fig. 2. Dissection of *S. triangularis*: *a*, portion of external sac reflected; *b*, peduncle; *c*, ovario-branchial orifice; *d*, horny disk; *e*, corium; *h*, internal ovaries; *i*, ovigerous lamellæ; *k*, portion of peduncle prolonged beyond the horny disk; *l*, vesicles; *o*, tubercle of anterior surface.
- Fig. 3. Anterior surface of interior ovaries removed from their connexions: *g*, the septum; *h*, mass of internal ovaries; *o*, tubercle (oviduct?); *e*, portion of adhering corium [these letters apply also to fig. 3']; *l*, the vesicles.
- Fig. 3'. Posterior view of internal ovaries of *S. carcini*.
- Fig. 4. *Sacculina triangularis*; external skin and corium reflected: *a*, external skin covered internally by the corium; *i*, ovigerous lamellæ.
- Fig. 5. Ovigerous sac, showing the anterior and posterior folds which embrace the internal ovaries.
- Fig. 6. Mass of ova from the ovigerous lamellæ.
- Fig. 7. Greatly magnified view of one of the vesicles, drawn from a fresh specimen: *a*, the duct of the vesicle; *c*, the structure found in the interior of the vesicle; *b*, the horny substance found at the commencement of the duct.
- Fig. 8. The same organ as fig. 7, drawn from a specimen preserved in alcohol: *a*, the convoluted duct; *b*, the horny process.
- Fig. 9. The structure found in the interior of the vesicle, removed.
- Fig. 10. *Sacculina carcini*, with no ovigerous lamellæ, nat. size: *b*, the peduncle; *b'*, intestine of crab; *c*, ovario-branchial orifice.
- Fig. 11. *Sacculina triangularis*, nat. size. (Same references as in fig. 10.)
- Fig. 12. *S. carcini* distended with ova.
- Fig. 13. Posterior view of fig. 12: *d*, horny attachment of peduncle; *k*, prolonged portion of the same.
- Fig. 14. A group of *S. triangularis*.
- Fig. 15. *S. inflata* (after Leuckart).
- Fig. 16. Enlarged view of the vesicles of *S. carcini*.

IV.—Descriptions of two new Species of *Coleoptera* from Angola.

By the BARÃO DO CASTELLO DE PAIVA, Professôr de Botanica na Academia Polytechnica do Porto.

THE following two species of *Coleoptera* were discovered in Angola by my learned friend Dr. Frederic Welwitsch; and I have great pleasure in naming one of them after him, and the other after M. Sabin Berthelot, the French consul at Teneriffe

and the fellow-labourer with Mr. Webb in the elaborate 'Histoire Naturelle des Iles Canaries.'

Fam. Buprestidæ.

Genus SPHENOPTERA.

(Dejean) Solier, Ann. de la Soc. Ent. de France, ii. 229.

Sphenoptera Bertheloti, Paiva.

S. elongato-obtriangularis, angusta, nitida, subvirescenti- et subænescenti-cuprea; capite prothoraceque (præsertim versus latera) sat dense punctulatis, hoc lineis duabus dorsalibus virescentibus plus minus obsoletis longitudinaliter ornato; elytris leviter striato-punctatis, sutura interstitiisque alternis postice paulo elevatis, utroque ad apicem ipsum 3-spinoso (spina suturali minutissima); antennis pedibusque concoloribus.

Long. corp. $5\frac{1}{2}$ lin.

Habitat "ad varias arbores et frutices spinosos agri Loandensis."—Dom. Welwitsch.

S. angusta, elongato-obtriangularis (*i. e.* antice lata, postice regulariter et facile acutior), sat nitida, subvirescenti- subænescenti-que cuprea, ubique minutissime et dense punctulata. *Caput et prothorax* (præsertim ad latera) punctis majoribus notata; *illud* antice late concavum, postice magis convexum; *hoc* apice capitis latitudine et ibidem leviter sinuato-emarginatum, postice paulo sed gradatim latius, margine postice undulato-sinuato, lineis duabus dorsalibus virescentibus plus minus obsoletis longitudinaliter ornatum. *Elytra* obtriangularia (*i. e.* apicem versus regulariter acutiora), striato-punctata, sutura interstitiisque alternis (postice saltem) paulo elevatis, utrumque ad apicem ipsissimum in spinas tres acutissimas parvas productum,—sc. suturalem minutissimam, mediam longiusculam et lateralem intermedia longitudine. *Antennæ et pedes* concolores.

This fine *Sphenoptera*, although at first sight allied to several recorded species, appears to be distinct from all hitherto described; and it does not tally with the diagnoses of any of the seven members of the genus given by Boheman in his 'Insecta Caffraria.' It is rather more variegated than the generality of the *Sphenoptera*, and is remarkable, amongst other peculiarities, for the two longitudinal metallic lines (which, however, are sometimes so exceedingly indistinct as to be almost obsolete) down the disk of its pronotum.

Fam. Lamiadæ.

Genus TRAGISCOSHEMA.

(Chevr.) Thomson, Arch. Ent. i. 67.

Tragiscoschema Welwitschii, Paiva.

T. cylindricum, pube brevissima demissa albida et atra densissime

laeteque pictum ; prothorace ad latera spina media parva instructo ; antennis pedibusque breviter cinereo-pubescentibus, illis nigrescentibus corpore longioribus, his ferrugineis.

Long. corp. 6-7 lin.

Habitat "ad varios frutices spinosos regionis littoralis."—Dom. Welwitsch.

T. cylindricum, angustum. *Caput* flavo-albidum, linea frontali transversa inter antennas oculosque (utrinque extra oculos producta) necnon plaga postica longitudinali triangulari centrali atris. *Prothorax* antice et postice capitis latitudine, ad latera utrinque paulo rotundatus et spina media minutissima instructus, mox ante basin leviter transversim constrictus ; flavo-albidus, linea latissima dorsali atrata notatus ; margine basali trisinuato. *Elytra* parallela, flavo-albida, sutura, apice, fasciis duabus magnis profunde dentatis (sc. subapicali et postmedia), per marginem exteriorem anguste connexis, maculis duabus parvis subsuturalibus (sc. antemedia et sub-basali) in lineam suturalem evanescentibus, necnon duabus versus humeros, omnibus in utroque positis, atris ornata. *Antennae* nigrescentes, sed brevissime et tenuissime cinereo-pubescentes, corpore (praesertim in sexu foemineo) longiores. *Pedes* ferruginei, brevissime cinereo-pubescentes.

A beautiful and most elegant Longicorn, and one which appears to be quite distinct from every species of the genus, or of *Tragocephala*, which has hitherto been described. It seems to be somewhat allied to the *T. gracilicornis* of Chevrolat, from Port Natal. I am glad to have an opportunity of dedicating it to my excellent friend Dr. F. Welwitsch, whose vast botanical researches are likely to throw much light on the flora of that interesting region, and by whom the insect has been lately discovered.

Lisboa, de Novembro de 1861.

V.—On two new *Rhynchophorous Insects* from Angola.

By T. VERNON WOLLASTON, M.A., F.L.S.

HAVING lately received from the Barão do Castello de Paiva a small but valuable consignment of Coleoptera collected by Dr. C. Welwitsch at Angola, I have selected the following two species, from a family in which I am more peculiarly interested, that I may append them to the paper of my learned friend, as some slight recognition of his varied services in the cause of science. And I feel glad, at the same time, to be permitted to couple with his name that of so acute and eminent a naturalist as Dr. Welwitsch, whose labours in this most interesting and but little-known region of Western Africa have been pursued with unwearied diligence for many years.

Fam. Curculionidæ.

Genus PIAZOMIAS.

Schönherr, Gen. et Spec. Cure. v. 936 (1840).

Piazomias Welwitschii, n. sp.

P. niger, squamulis parvis demissis submetallico-albidis undique irroratus; rostro utrinque bicastato, in medio canaliculato; prothorace brevi, ad latera valde subampliato-rotundato, dense granulato, canaliculato; elytris pone basin constrictis, in medio rotundato-ampliatis, ad humeros obsolete calloso-tuberculatis, profunde punctato-striatis, per basin ipsissimam elevatis, ad apicem singulatim minute acuminatis; antennis ad basin pedibusque posterioribus piceis, pedibus anticis longissimis.

Long. corp. lin. 4-4 $\frac{3}{4}$.

Habitat "ad frutices varios et ad gramina altiora regionum littoralis et montanæ."—Dom. Welwitsch.

Genus SCIOBIUS.

Schönherr, Gen. et Spec. Cure. ii. 534 (1834).

Sciobius Paivanus, n. sp.

S. ovatus, nigro-fuscus sed squamulis parvis demissis albidis parce nebulosus; rostro utrinque carinato; prothorace brevi, subconico; elytris profunde punctato-striatis setisque erectis rigidis obsitis, obscure albido-tessellatis; antennis, tibiis tarsisque fusco-ferrugineis.

Long. corp. lin. 2 $\frac{2}{3}$.

Habitat "ad varias leguminosas spinosas regionis littoralis." — Dom. Welwitsch.

I am informed by M. Jekel, who is so well known for his accurate and extensive knowledge of the Curculionidæ, that both of these insects are unquestionably new; and I have therefore much pleasure in naming them as above.

VI.—*A Catalogue of the Zoophytes of South Devon and South Cornwall.* By the Rev. THOMAS HINCKS, B.A.

[Continued from vol. viii. p. 366.]

[Plate VII.]

MOLLUSCOIDA.

Class POLYZOA, J. V. Thompson.

Order INFUNDIBULATA, Gervais.

Suborder Cheilostomata, Busk. Fam. Salicornariadæ.

SALICORNARIA, Cuvier.

1. *S. farciminoides*, Ellis & Solander.

Common, in shallow and deep water: on rocks near the

Scallop-bank, Salcombe Bay ; near the Oar-stone, Torbay, in about 8 fathoms ; amongst the trawl-refuse, abundant, &c.

Large masses of this beautiful species were obtained in Salcombe Bay, intermingled with a brilliant scarlet Sponge, which were torn by the dredge from the rocks, in about 15 or 20 fathoms' depth*.

2. *S. sinuosa*, Hassall.

Common, in deep water : as abundant as the previous species amongst the trawl-stuff.

Fam. Cellulariadae.

1. CELLULARIA, Pallas.

C. cuspidata, Busk.

A single specimen has been obtained by Mrs. Gulson amongst the refuse of one of the Brixham trawlers. It is a common Australian species.

[Vide 'Annals' for Feb. 1855, "Notes on British Zoophytes."]

2. SCRUPOCELLARIA, Van Beneden.

1. *S. scrupsea*, Busk.

Not uncommon : off Berry Head ; Salcombe Bay. It grows in close compact tufts.

[On stones, off St. Ives, Cornwall.]

2. *S. scruposa*, Linnæus.

Very common.

3. CANDA, Lamouroux.

C. reptans, Pallas.

Extremely abundant, chiefly on weed : plentiful in the Laminarian zone, where it spreads luxuriantly over *Halidrys siliquosa* and other Algæ ; also amongst the trawl-stuff.

Fam. Scrupariadae.

1. SCRUPARIA, Oken.

S. chelata, Linnæus.

Very common on weed, shells, &c. : tide-pools ; Salcombe Bay, on *Laminaria digitata* (a favourite habitat), &c. It sometimes overspreads the fronds of the last-named weed with dense miniature forests.

* A small branch of this species was found by M. Milne-Edwards attached to a portion of the telegraphic cable which formerly connected Sardinia and Algeria. The piece on which the Polyzoon was growing had been taken up from a submarine valley, lying between Bône and Cagliari, which is from 1000 to 1500 fathoms in depth.

This species, when growing on shells, is not uncommonly recumbent and adnate, and creeps over the surface like a *Hippothoa*. It is a curious fact that in this condition it assumes the mode of growth of the latter genus, and sends off branches from the sides of the cells. The aperture, too, is not distinctly margined, as in the erect form.

I have many specimens of this variety, which were dredged off the Isle of Man, where it is common on oyster and other shells. They form *Hippothoa*-like patches, and generally show the process, springing from the front of the cells (below the aperture), which marks the commencement of a branch or of an ovicelligerous cell. So completely are the habit and aspect of the Polyzoon changed in this repent variety, that it is difficult to recognize it under its disguise. When I first met with it, I had no doubt that I had obtained a new species of *Hippothoa*; but I have since found a specimen in which an erect shoot of the normal character springs from the line of creeping cells.

I have *Scruparia chelata* in the same condition from Australia, where the species is common.

2. HIPPOTHOA, Lamouroux.

1. *H. catenularia*, Jameson.

Very common in deep water: spreads profusely over the Cornish *Pinnae* from 60 fathoms.

2. *H. divaricata*, Lamx.

Very common: from between tide-marks (rarely) to deep water. Some of the most beautiful specimens which I have seen were spread over the smooth inner surface of the *Pinna ingens*.

The variety *Patagonica* occurs on red weed at Sidmouth.

[Hobson's Bay, Australia.]

3. ÆTEA, Lamouroux.

1. *Æ. anguina*, Linnæus.

Extremely common: on Algæ (especially the red), Corallines, &c., in tide-pools, and the Laminarian zone.

2. *Æ. truncata*, Landsborough.

On shells, apparently not common: Plymouth, &c.

In his description of this species, Dr. Landsborough makes no mention of the curious spur-like processes with which the cells are often furnished. They spring from the back of the cell below the aperture, and are generally of considerable length.

[Ramsay, Isle of Man; common.]

3. *Æ. recta*, n. sp. Pl. VII. fig. 3.

Cells long, nearly straight, truncate at the extremity; surface coarsely ringed below, the upper portion punctulate; aperture elongate, not dilated.

Abundant on shells and other submarine bodies: Torbay; Salcombe; from 60 fathoms off the Deadman, &c.

In this species the creeping base is composed of a series of fusiform expansions, connected by a delicate thread of variable length, and closely resembling the cells of a *Hippothoa*. They are regularly formed, enlarged and rounded at one end, and pointed at the other. The cells are placed at the extremity of the larger end; they are straight or a little curved, long, truncate, *very slightly* enlarged above; surface ringed below—more coarsely than in *Æ. anguina*,—covered with minute punctulations above; aperture elongate, occupying a large proportion of the length of the cell.

Æ. anguina may be at once distinguished from the present species by its bent and spatulate cell. It is also of inferior size.

There can be little doubt that Mr. Couch's *Hippothoa sica* (Corn. Faun. iii. 102, pl. 19. fig. 8) was founded on specimens of this species in which the cells were broken off or only partially developed. His description applies exactly to *Ætea recta* in this state. Indeed, when stripped of its cells, or with only a small portion left, forming a tubular aperture at the extremity of the clavate expansions, it is undistinguishable from a *Hippothoa**. The mode of branching is the same as in the latter genus, the branches being given off from the sides of the cells. *Ætea recta* is abundant on the coast where Mr. Couch's investigations were carried on.

[Isle of Man, dredged on shells; Lamlash, Arran.]

4. BEANIA, Johnston.

B. mirabilis, Johnst.

Common: creeping amongst *Bugula turbinata*, rock-pools, Exmouth; on *Laminaria*-roots, Salcombe Bay; on stones between tide-marks, Torquay, &c.

[Ramsay, Isle of Man, on weed; off the coast of Antrim, on shell; Lamlash.]

* The upper portion of the cells of *Æ. recta* is very commonly broken off a little below the base of the aperture.

Fam. Gemellariadæ.

1. GEMELLARIA, Savigny.

G. loricata, Linn.

Not common.

This species, which is so abundant in some districts (as, for instance, on the Lancashire coast), is of comparatively rare occurrence in Devon.

"Near the shore, rare; Polperro" (*Couch*).

2. NOTAMIA, Fleming.

N. bursaria, Linn.

Dr. Johnston states that he received specimens of this interesting polyzoon from Devonshire, through Mrs. Griffiths: they were parasitical on *Plumularia falcata*. I have never met with it either there or in Cornwall.

Fam. Cabereadæ.

CABEREA, Lamouroux.

1. *C. Boryi*, Audouin.

Amongst trawl-refuse taken up off Budleigh-Salterton. In 1854, I found several small tufts growing amidst a mass of *Scrupocellaria scruposa*. Miss Cutler had previously obtained very fine specimens from the same locality on *Eschara foliacea*.

[2. *C. Hookeri*, Fleming.

Fleming founds his description of this species on a specimen which he had received from Dr. Hooker, and which was said to have been obtained at Torquay.

This is, I believe, the only record of the occurrence of *C. Hookeri* out of the north; and one can hardly help suspecting that there has been some mistake about it. Prof. E. Forbes found it in Shetland, and Mr. Barlee in the Orkneys. It has not occurred either to Mr. Couch or myself in the west. At present, its claim to a place in this Catalogue must be considered very doubtful.]

Fam. Bicellariadæ.

1. BICELLARIA, De Blainville.

B. ciliata, Linn.

Very common: on Sertularian Zoophytes, &c.

2. *BUGULA*, Oken.

1. *B. flabellata*, J. V. Thompson.

Common : frequently on *Eschara foliacea* ; on *Gorgonia* from 30 or 40 fathoms ; in shells from Salcombe Bay, &c.

2. *B. avicularia*, Pallas.

Not common : Plymouth.

3. *B. turbinata*, Alder.

Very abundant on rocks near low-water mark.

[Llandudno, N. Wales ; Isle of Man.]

4. *B. plumosa*, Pallas.

Not common : on scallop and other shells, &c., in Salcombe Bay ; "Polperro, rare" (*Couch*).

Fam. **Flustridæ**.

FLUSTRA, Linnæus.

1. *F. foliacea*, Linn.

Comparatively rare in Devon.

On the Cornish coast, between Rame Head and the Deadman, it is common, according to Mr. Couch.

2. *F. papyracea*, Ellis.

Not uncommon : dredged in Salcombe Bay, &c.

Fam. **Membraniporidæ**.

MEMBRANIPORA, De Blainville.

1. *M. membranacea*, Linn.

Very abundant, overspreading with its beautiful lacework the fronds of *Laminaria* and other sea-weeds.

2. *M. pilosa*, Pallas.

Universally distributed between tide-marks, encrusting various kinds of sea-weed, &c. ; also on shells, &c., from deep water.

A pretty, stellate variety, of very delicate texture, occurs in deserted shells of *Pectunculus glycimeris* from Plymouth.

3. *M. Rosselii*, Audouin.

On shells from Torbay, sometimes forming very large patches. [Off Maughold Head, Isle of Man.]

4. *M. Flemingii*, Busk.

Very common, on shells, stones, &c. : from 60 fathoms, off

the Deadman; from 40 fathoms, ten or twelve miles south of Polperro, &c.

The specimens from these deep-water habitats exhibit very fully the distinctive characters of the species.

5. *M. Pouilletii*, Audouin.

Abundant; frequently overspreading the interior of deserted shells, &c.

6. *M. imbellis*, Hincks.

Occasionally from deep water: off the Deadman, from 60 fathoms; on shell from the Brixham trawl-boats.

Weighty as Mr. Busk's judgment on such a point undoubtedly is, I find myself unable to agree with him in regarding *M. imbellis* as "an unarmed variety of *M. Flemingii*." Its cells are much larger than those of the latter species, and more widely separated; and the numerous specimens which I have examined from very various localities have been uniformly destitute of the calcareous expansion, as well as of the spines and avicularia, which distinguish *M. Flemingii*.

7. *M. Lacroixii*, Savigny.

Encrusting stones and shells between tide-marks, not uncommon; also dredged in moderate depths.

In sheltered situations, the cells are completely set round with delicate spines, which bend inwards. Johnston's plate 57. fig. 11 represents this condition.

8. *M. hexagona*, Busk, 'Microscopical Journal' for 1856, page 308. pl. 12. fig. 4.

"Coast of Devon (*Miss Cutler*); Fowey Harbour (*Peach*)."

9. *M. monostachys*, Busk.

Spreading over the surface of a stone, between tide-marks, Torquay.

The Torquay specimen, which I refer to this species, differs in some respects from Mr. Busk's description. The cells are arranged in linear series, of varying width, and are prolonged and attenuated downwards; the aperture is oval, and the margin armed with numerous spines; about seven or eight are ranged on each side, the uppermost pair being larger than the rest and standing erect; below the aperture, there is a prominent acuminate spine, slightly curved. In the *M. monostachys* as described by Busk, the latter only is present,—the margin being otherwise unarmed. The shape of the cell is the same in the two forms; and the presence or absence of the delicate marginal

spines is probably dependent, as in the case of *M. Lacroixii*, on situation.

[Ilfracombe, on the Capstone Rocks. The specimens from this locality are destitute of the spines.]

10. *M. lineata*, Linn., Alder, Northumberland Catal. p. 53,
pl. 8. fig. 1.

Abundant between tide-marks.

11. *M. spinifera*, Johnston.

On stone, between tide-marks, Salcombe; Goran (*Peach*).

[Ramsay, Isle of Man, between tide-marks.]

12. *M. curvirostris*, n. sp. Pl. VII. fig. 4.

Cells oval, regularly disposed; aperture with a membranous covering; margin raised, slightly thickened, subgranular, with a short stout spine on each side near the top; ovicells globular, prominent, strongly frosted and silvery; avicularia scattered, very large, raised, sloping upwards, with a pointed and curved mandible.

On stone from 40 fathoms, ten or twelve miles south of Polperro.

The most characteristic points in this species, which forms a neat and delicate network on the stone, are the regularly oval cells and the large and raised curvirostrate avicularia, which occur here and there, and are situated at one side of the cell near the top. The two spines project immediately below the ovicell.

[*M. craticula*, Alder.

Mr. Alder regards the *Flustra lineata* of Couch's 'Cornish Fauna' as probably identical with this species; and, judging merely from the description and figure, I should have formed the same opinion. Mr. Peach, however, has kindly sent me a specimen of *Membranipora* from Goran, which he believes to be the *F. lineata* of Couch; and this turns out to be the *M. spinifera*, exhibiting many of the characteristic club-shaped spines which bear the avicularia. As Mr. Peach is specially mentioned in the 'Cornish Fauna' as having supplied specimens of *F. lineata* from Goran, on which, amongst others, Mr. Couch founded his description, I now hesitate to identify this species with *M. craticula*. It is not improbable that both forms may have come under his notice, but for the present this point must remain doubtful.

Off Ramsay, Isle of Man, this species is abundant on shells dredged from the Scallop-banks.]

EXPLANATION OF PLATE VII.

Fig. 1. *Coryne vaginata*, Hincks (Ann. ser. 3. vol. viii. p. 295), from a tracing of Lister's figure of *Coryne* in the Phil. Transact.: 1 a, the cup-like expansion of the polypary.

Fig. 2. Gonophore of *Eudendrium insigne*, Hincks.

Fig. 3. *Ætea recta*, Hincks.

Fig. 4. *Membranipora curvirostris*, Hincks.

VII.—Further Observations on some Novel Phases of Organic Life at great depths in the Sea. By Dr. G. C. WALLICH.

To the Editors of the *Annals and Magazine of Natural History*.

GENTLEMEN,

In the course of some experiments conducted by me, with a view to ascertain the relation subsisting between the sarcodic contents and the calcareous shells of the Foraminifera, a fact so curious revealed itself, as to suggest the possibility of its being rendered available for the solution of various questions in microscopic analysis.

A deep-sea deposit containing numerous Foraminiferous shells, principally *Globigerina*, was subjected to the action of fluoric acid, both at the ordinary temperature and at the boiling-point. When subjected to boiling for a period of about a couple of minutes, entire solution of the calcareous, silicious, and vitreous (volcanic) particles took place, and the masses of sarcode were disintegrated and broken up into extremely minute somewhat acicular granules. These granules, however, in all probability, do not consist of pure sarcode, but of that substance or its elements in combination with fluoric and silicic acids. Seen under the microscope, they did not serve to throw any new light on the characters of sarcode, either with or without the employment of the polariscope.

The portion of deposit submitted only to a momentary immersion in cold fluoric acid gave off a copious discharge of carbonic acid; but on being carefully washed and examined under the microscope, little or no effect seemed to have been produced on the majority of the *Globigerina*-shells, beyond a reduction in the thickness of the walls in some, and in others what appeared to be an alteration in the outline of the superficial elevations, which, in the case of the older shells, are conical and present a zeolite-like aspect when fractured.

The silicious organisms and vitreous particles were very partially affected, the micaceous scales remaining quite intact.

On mounting the shells acted on in the latter mode, some in balsam, some dry, all depolarizing effect was destroyed, there being no coloration in a single specimen; whilst all trace was obliterated of the remarkable and distinctive black cross ordinarily presented by *Globigerina* when viewed under the polariscope. On the other hand, the micaceous tablets retained their full depolarizing properties, and evolved the most brilliant colour.

Again, the bodies detected by me in the deep-sea deposits and which I denominated Coccospheres*, as indicative of their relation to the Coccoliths of Professor Huxley, though abundantly present in the material operated on, were not destroyed by the cold acid. But the minute black crosses which they evoke when observed under the polariscope were, in like manner with that of the perfect *Globigerina*-shells, wholly obliterated.

In a few shells a change of crystalline structure appeared to have taken place, inasmuch as the bold conical elevations already referred to were replaced by crystals of the cubical series, resembling in all respects the natural crystals of the fluoride of calcium. Accordingly, it is probable that, notwithstanding the transitory period of their immersion, the carbonic was replaced by fluoric acid, and the peculiar depolarizing power resident in the normal arrangement of particles destroyed.

On the other hand, it is possible, although hardly probable, that an entirely new combination, dependent on alterations induced in the sarcodic matter with which the *Globigerina*-shells and, I believe, the Coccospheres and Coccoliths are, in a measure, invested, may have exercised a similar action as regards depolarization.

At all events, we are here furnished with a new and simple method of testing microscopically for carbonate of lime—a salt which enters largely into the composition of so many marine and other deposits, and is associated with so many of the minute organisms that frequent both salt and fresh water.

My own time being already fully occupied, I must leave the further investigation of the matter to others. Perhaps I may be permitted to remark that no one is more competent to extract the true significance of the fact than Mr. Sorby, whose researches on Pseudomorphs are so well known.

Meanwhile, may I request you will do me the favour to insert this notice in 'The Annals?'

I remain, Gentlemen,

Your obedient and obliged servant,

G. C. WALLICH.

* See a notice by me in the Ann. & Mag. of Nat. Hist. No. 43 (ser. 3. vol. viii.), and the article on the so-called Crystalloids of the Chalk, by Mr. Sorby, in No. 45.

VIII.—*Note on Myxotrichum chartarum (Kunze).*

By ARTHUR H. CHURCH, B.A. Oxon., F.C.S.

[Plate VI.]

My attention was first directed to this beautiful fungus by my friend Mr. Northcote, of Queen's College, Oxford, who noticed its occurrence on damp cotton fibres: it is generally found on damp straw or paper. It was first figured by Kunze, and afterwards by Corda. As the works of these authors are not easily accessible, I thought that a careful drawing, traced from the plant itself by means of the camera lucida, might prove acceptable to British fungologists. Plate VI. fig. 1 represents three plants of their natural size; fig. 2, the same three plants slightly enlarged; and fig. 3, a single plant magnified 400 diameters.

The fungus is of a deep-brown colour, and horny texture. The mycelium is dichotomously branched for the most part; and the original portions of it increase centrifugally, so that the mature plant finally assumes the spherical form. Among the growing points of the mycelium which make up this sphere, from three to thirty processes of singular form project. These hooks are curved more or less spirally at their outer extremities, and are divided transversely into nine or ten segments. Fig. 4 shows a branched spiral hook ("zusammengerollter Haken" of Corda), separated from the mass of mycelium, and magnified 800 diameters. Corda's figure*, which is not altogether satisfactory, does not disclose any segmentation of the spirals; he describes only the separation that can be effected between their outer and inner parts. Towards the centre of the fungus, when mature, a confused yellow mass may be noticed. When this yellow mass is carefully separated from the flocci, and a portion of it examined, it appears to consist of thin fragile sacs of a clear deep-yellow colour; these soon burst and set free a number of white or grey oval bodies: the latter I take to be spores, the former a kind of enveloping membrane, resembling the cyst in *Badhamia*. Figs. 5 *a* and 5 *b* represent these spores, and fig. 5 *c* the supposed spore-sacs after they have discharged their contents. The spores readily vegetate among damp cotton-fibres; and I have raised from them a new supply of the fungus: fig. 6 represents two young plants. The yellow bodies here referred to are apparently identical with those described by Corda as spores: he speaks of them as of a golden-yellow colour, and attached, in compound chains of a branching form, to certain central portions of the mycelium. I have not yet been able to discover them *in situ*, and I must leave their true relations an open question. Moreover the septate character (not recognized

* *Icones Fungorum*, tom. vi. tab. 2. fig. 23. 4 *d*.

by Corda) of the spirals renders it necessary to view these appendages also in another light; in fact, this character seems to connect *Myxotrichum* with *Helicosporium* and similar genera, where the filaments bear strings of sporidia coiled up into spirals, and at the same time to show, as indicated in fig. 4. Pl. VI., the intimate connexion subsisting between the ordinary spores of the Hyphomycetes, whether arranged in chains or occurring singly, and the bodies termed *conidia*.

Hitherto our information concerning the position of this fungus has been but scanty. In the 'Micrographic Dictionary' of Griffith and Henfrey (ed. 2, p. 483), the genus *Myxotrichum*, to which our present species was referred by Kunze, is thus noticed:—"A genus of Dematiei, growing on rotten wood, paper, &c. Three species are described as British—*M. casium*, Fr., *M. chartarum*, Kze., and *M. deflexum*, Berk. They form little tufts or downy balls, sending off radiating branched filaments. The spores are described as occurring collected in masses about the base of the threads (?)." In Mr. Berkeley's 'British Fungology' (p. 353), the genus *Myxotrichum* is referred to the Mucedines, and its characters given as follows:—"Flocci branched, bearing towards their base little conglomerate masses of spores." Corda placed his genus *Actinospira* among the Sporotrichaceæ, describing it thus:—

"*ACTINOSPIRA*. Flocci ramosi, continui, cornei; sporis simplicibus, basi in glomerulos coloratos heterogeneos conglutinatis.

"*A. chartarum*, Corda, tom. vi. tab. 2. fig. 23. Acervulis subglobosis; sporis ooideis aureis."

Mr. Berkeley, to whom I am indebted for my information as to the history of the present plant, tells me that it is supposed to be a condition of some *Chaetomium*. I hope my observations and the figure given may aid in determining its true relations.

Mr. Berkeley's *Ascotricha chartarum** presents, in the appearance of the thallus and conidia†, a slight approach to the character of the young plants of *Myxotrichum* figured in my drawing; but the genera to which the plants belong are, so far as present observations go, quite distinct.

IX.—*Observations on a Species of Pycnogon* (*Phoxichilidium coccineum*, Johnston), with an attempt to explain the Order of its Development. By GEORGE HODGE.

[Plates IV. & V.]

THE generation and development of the Pycnogonoidea, to the best of my knowledge, have hitherto received a very small share

* Ann. Nat. Hist. ser. 1. vol. i. pl. 7, p. 257.

† *Ib.* pl. 7. fig. 8 d.

of attention. Many naturalists, during their investigations, must have noticed and recorded certain facts bearing upon these points; but it unfortunately happens that these have either remained unpublished, or are inaccessible to the ordinary student, who is therefore left to grope in the dark, and to rely upon his own observations and research for any knowledge of this interesting subject that he may be desirous of obtaining. Little has been said of the anatomical differences of the sexes; we only know that most, if not all, of the females of the several species possess an additional pair of members, anterior to the ordinary feet. These members, known by the name of 'false feet,' differ in different genera, have been made an important aid in classification, and are furnished with a number of setæ, of forms varying according to the genus or, it may be, species; and near to these setæ, at certain periods, the eggs or ova are found.

We know nothing of the earliest stage, or means by which the ova are produced and fertilized; and, so far as I am aware, the subject has not been alluded to by any writer on these animals. The only published record to which I have had access is a paper by Kröyer in the 'Annales des Sciences Naturelles' for 1842, being "Notes on the Metamorphosis of the Pycnogonides," wherein the larval forms, as attached to the females of *Pycnogonum littorale*, *Nymphon grossipes*, and *Phoxichilidium femoratum*, are figured and described. I have also been kindly favoured by Mr. Spence Bate with some MS. notes "On the Morphology in the Development of the Pycnogonidæ," which were read at the British Association Meeting of 1855. These authors, however, go no further than the larval forms, and make no allusion to the subsequent stages through which the young animals pass before they attain the mature state; therefore the following observations, although imperfect in some most important particulars, may perhaps be the means of guiding others in the search, and thus ultimately lead to the complete elucidation of the development of the Pycnogonoidea.

The species that afforded me material for the following observations, and which I believe to be *Phoxichilidium coccineum* (Johnston)*, may frequently be taken at low-water mark, crawl-

* *Orithyia coccinea*, Johnston. "Animal araneiform, slender, of a uniform fine clear red colour, with the joints of the legs and tarsi yellowish, and, when magnified, a central vessel, distinguished by its deeper tint, is seen running uninterruptedly through the body and legs: rostrum yellowish, porrect, cylindrical, somewhat thickened outwards, divided beneath by a mesial line shorter than the mandibles, which originate from the anterior margin of the first segment, and are biarticulate; the basal joint long, while the second forms a short ovate hand armed with two subequal curved claws: body 4-jointed, the first with an oculiferous tubercle; the eyes obscure: legs four pairs, with a few widely scattered short hairs;

ing or, rather, sprawling over Algæ and Zoophytes, more frequently the latter. In most instances I have met with them on a muddy bottom, probably because the Zoophytes on which they seem to feed are found there. During a careful and systematic series of "rock-hunts," undertaken with the view of obtaining a collection of the smaller and rarer marine animals of this part of our coast [Seaham], I collected a handful of a species of *Coryne* (*C. eximia*, Allman) from a small rock-pool, under the shelter of the overhanging side of which depended a most interesting fringe of Zoophytes, such as *Coryne*, *Tubularia*, *Plumularia*, &c. The *Coryne* was very abundant; and many of the polyparies attained the unusual length of 3-4 inches, and were, at the period when taken (August), profusely covered with Medusoids in various stages of growth. As I collected these specimens, I noticed some peculiar dark brownish-red pear-shaped sacs scattered over the stems, more especially on the lower portions. Concluding they were some peculiar organisms connected with the growth of the *Coryne*, they did not receive more than a passing glance; but on arriving at home, the specimens were turned out into dishes, and by accident a hand-lens was applied to one of the dark-red sacs, when it was seen that the red colour depended principally upon a central portion, resembling in an extraordinary degree a small *Pycnogon* with very short legs. The sac was then ripped up; and the imbedded object, being extracted and gently freed from the investing mucus, proved to be a veritable young *Pycnogon*. Here was a discovery—a Crustacean (?) within a Zoophyte! Puzzled and surprised, I endeavoured to ascertain more of the extraordinary partnership (the benefit all on one side, I am inclined to think) that appeared to exist between the *Coryne* and the *Pycnogon*.

three times the length of the body, equal, 8-jointed; the basal joint short; the second somewhat longer than the third; the fourth slightly dilated, elongate; fifth and sixth slenderer, but as long; seventh minute; eighth rather long, falciform, spinous on its inferior edge, and terminated by a single rather long claw. [There are *two* claws: one is very small, and is rather difficult to see, from its position; it issues from the base of the larger, near to its insertion into the falciform joint, and clings closely to the larger claw.—G. H.] Length of the body 2 lines, of the legs 6 lines. With a common magnifier, the body appears very smooth; but when a more powerful glass is used, it and the legs are seen to be roughish with minute granules." ("An Attempt to ascertain the British *Pycnogonidæ*," by Geo. Johnston, M.D., in 'Magazine of Zoology and Botany,' vol. i.)

Phoxichilidium coccineum, Milne-Edwards, 'Crust.' vol. iii. p. 536, 1840 (Goodsir, in 'Annals and Magazine of Natural History,' vol. xiv. 1844).

Nymphon femoratum (Rathke, Nat. Hist. Skrifter, vol. i. p. 201).

Phoxichilidium femoratum, Kröyer, in 'Annales des Sciences Naturelles' for 1842. In speaking of this species, he says, "I believe this animal identical with the *Orithyia coccinea* from the coasts of England."

The natural inference on first finding these sacs would be that they had been attached by the mature *Pycnogon*—in fact, were the germs cemented to the polypary, and that the difference in form (pear-shaped, instead of globular as when attached to the false feet of the female) might be the result of growth. On submitting, however, the sacs to microscopical examination, their external appearance so closely resembled the growth of *Coryne*, and, on the other hand, was so totally different from anything that could be imagined to be the product of a *Pycnogon*, that little doubt remained on my mind that the sacs were really the result of some peculiarly directed growth of this zoophyte. To ascertain, therefore, how far the cavity of the sac communicated with the central portion or cœnosarc of the *Coryne*, a sac was cut transversely, near to its connexion with the supporting stem; and a gentle pressure being applied, the nutrient matter of the *Coryne* escaped from the wound, just as would be seen if a stem was so cut. Transparent specimens were next examined, and the result left no doubt of the sacs being part and parcel of the *Coryne*. All question upon the matter was, however, completely set at rest by my finding that these sacs had been already noticed by Prof. Allman, who, in a communication made to the British Association in 1859, arrived at a precisely similar conclusion with respect to their zoophytic origin. The abstract of his paper, being very short, may be here quoted entire.

“On a remarkable form of Parasitism among the *Pycnogonidæ*.”

“By Professor ALLMAN, M.D., F.R.S.

“The author described the occurrence, on the branches of some species of *Coryne*, of peculiar pyriform vesicles, which might at first sight be easily taken for the reproductive sacs of the Zoophyte. They had their cavity in free communication with the general cœnosarc of the Zoophyte; and an endoderm, ectoderm, and external chitinous investment were easily demonstrable in their walls. The nature of their contents, however, at once distinguished them from the proper reproductive sacs of the *Coryne*; for in every instance they enclosed a *Pycnogonidan* (*Ammothea?*). The enclosed *Pycnogonidan* was always solitary, and in the smaller vesicles was still embryonic, while in the larger ones it presented an advanced stage of development, and was ready to escape from its confinement by the rupture of the surrounding walls.”

Now come the questions:—How is the sac formed, and how does the young *Pycnogon* get into the sac? These problems are more difficult to solve than would at first appear; yet it may, I think, be proved that at any rate the sacs are merely modified growths of the Zoophyte.

If figs. 6, 7, 8, & 9, Pl. IV. are examined, it will be seen that

the sacs present a strong likeness to "stunted branches" of the polypary, as if a shoot had been suddenly brought to an abrupt termination by an enlargement consequent upon its occupation by a young *Pycnogon*. This view of the case becomes more evident if we examine the annulated character of the sac, which will be found to agree closely with the same parts seen in the polype, which are similarly annulated. It would therefore appear as if the young *Pycnogon* occupied the place of the ordinary polype in the *Coryne*. The sacs are usually found on the lower portions of the stems branching out from the sides, as shown at fig. 6, though occasionally they were met with much higher up. The only manner in which I can account for their position on the lower portions of the stems is this: the young *Pycnogons*, judging from their growth and the circumstances under which they are found, must have gained access to their tenements at an early period of the year, when the *Coryne* was but small; and the higher branches would seem to be growths subsequent to the period at which larval forms abound, which have risen above the level of the parasitically infested shoots.

I possess a female *Phoxichilidium*, taken during the present year, at Lerwick, by the Rev. A. M. Norman, which has several germs or ova seated on the false feet: from an examination of this specimen I was so fortunate as to obtain a clear insight into some of the very early stages of the ova, which, so far as I can judge, throw much light upon the subsequent stages.

Each sac or germ contains a large number of minute ova, which are attached to the investing membrane by four filamentous appendages. These ova, in early stages, are globular (see fig. 1), and appear to consist of a number of granules enclosed in a transparent envelope, from whence proceed the filaments just alluded to. As these granules increase in size, they undergo a sort of segmentation, and put out six rounded lobes, four being at the precise spots from which the filaments are produced, while the remaining pair are larger, appearing between the two pairs, and rapidly increase into two prominent processes, which soon assume the form of foot-jaws (see figs. 2 & 3), and are each provided with a pair of "nippers." The first four warts, two and two, continue their growth, increasing in length very considerably, and ultimately produce four legs, which, though unjointed, are capable of considerable movement. From the tips of these legs the long filaments are seen to proceed; and these have also considerably increased in dimensions, especially at their junction with the legs. Meanwhile the foot-jaws have also considerably enlarged, and by their outward growth have given place to another lobe or wart between them, which shortly assumes the form of a rostrum. And now we see a little *Pyc-*

nogon (fig. 4), with only four legs, it is true, but those members are of surprising length, and serve the purpose, I apprehend, of attaching the several larvæ to each other and to the sac containing them.

Having, therefore, seen the form and apparent principle of development of the ova from a mere mass of granules up to a period not far from that at which they would burst their bonds and enter upon a different life, we now come to the most difficult question—How does the young Pycnogon gain access to the Coryne? For the actual indisputable answer to this I am afraid we must patiently wait; at present, we can but surmise and guess at the process. I may perhaps be allowed to record my opinion; right or wrong, future results must settle. We have seen that the young Pycnogon, at the most mature stage at which I have observed it attached to the female, possesses a rostrum, a well-developed pair of foot-jaws (being in fact the most perfectly organized portion of the animal at this stage), and four rudimentary legs, terminated by very long filaments, which attach the young animal in an indirect way to the female. From the appearance of the outer membrane investing the little animal, and the rudimentary character of the legs, I expect a moult would shortly take place, and the animal would then entirely free itself from the investing skin and legs, with their attached filaments, being then of a globular form, with a pair of foot-jaws and a short rostrum. At this stage of the development the little animals become free, and here we lose all trace of them as connected with the adult Pycnogon; we should naturally expect that there was little chance of ever again falling in with them in their young state, in consequence of their minute size at this period ($\frac{1}{500}$ to $\frac{1}{400}$ inch across); and doubtless many observers have lost them at this stage. I imagine they are carried by the waves into pools, similar to that before alluded to, and containing a quantity of Coryne. The young animal would naturally cling to any fixed support, and, it may be, progress in some peculiar manner, and thus reach the polypes, or else the tentacles reach it, and shortly afterwards it is conveyed to the oral orifice of the Zoophyte, and being engulfed, is again lost to us, as, once in the Coryne, it becomes the food of that animal, and we cannot doubt that it possesses some means of digesting and assimilating such particles of matter, vegetable or animal, as may serve as nutriment. The young Pycnogon, having been received into the cœnosarc of the Zoophyte, must necessarily undergo the process of digestion and consequent dissolution: but in this particular case we find the ordinary rule does not hold; for the young Pycnogon is found whole and undergoing development within the polypary: if it has passed in by the

oral orifice, it has by some peculiar means escaped the common fate of most small animals that the polype gets hold of; and if it did not pass in by this aperture, how did it get in? I can see no other means of entrance; and when we remember that in many cases peculiar forms of animal life are found in the intestines and other parts of various animals of higher grades than those at present under consideration, to which they could only have gained access by the mouth of the animal they infest, and must therefore have been subjected to the process of digestion in their passage to those parts where they are found, it does not appear so very extraordinary that a parallel case exists amongst low forms of marine life. There is no other view of the case that I can conceive at all tenable. The polypary, from consisting of a strong horny envelope, would utterly defy the attacks of a puny animal like that under consideration, assuming, for the sake of argument, that the young animal desired admittance through the polypary, and endeavoured, in its humble way, to gain an entrance by means of its foot-jaws: such a view will, I think, be admitted as utterly unlikely. So far then as I can see, in the absence of a better, we must at present content ourselves with the opinion before expressed.

The young *Pycnogon* being now within the *Coryne*, we will endeavour to trace the future stages. The little animal, once within the *cœnosarc*, doubtless makes the most of its foot-jaws, and commences a search for a suitable "locale." To the instinct or other directing agency by which it is guided in this search, I am not prepared to allude: it is sufficient if we take it for granted that it does move freely along the tube of the polypary; whether by accident or instinct, it matters not. A glance into the circumstances of the growth of the *Coryne* may assist us in understanding the fact of the *Pycnogon* being found in a sac, without doubt produced by this *Zoophyte*.

The *Coryne*, at the time the larval forms may be expected to gain an entrance, from being of humble growth, as before mentioned, would not possess many polypes; numbers would, however, be in course of production. So far as I know, the growth of these polypes results from a branch springing from a stem, at first short and rounded at the free end; the rounded portion, however, changes its character from a thin investing membrane (or membranes) into a "fleshy head" or polype, at first rudimentary, but capable of producing its several parts. During the period that these short rounded branches exist, and before they have begun to assume the polype-character, a young *Pycnogon* enters one of them, having made a journey from the polype by which it entered, along the *cœnosarc*al tube of the *Coryne*; arrived at the end, there it remains to mature, and, by

a wonderful provision, the development of the terminal portion of the polypary into a polype is stayed (Pl. V. figs. 7 & 8), doubtless by the young Pycnogon availing itself of the nutrient matter circulating within the coenosarc as food, and thus withdrawing the material that should have developed a polype. The outer envelope or portion of the polypary (at this particular part) gradually enlarges, so as to assume the form and appearance before described, and the Pycnogon being comfortably housed amidst an abundant supply of food, nothing but time is requisite to enable it to undergo the necessary development.

With such an abundant supply of food as must necessarily be presented to the young parasite within the Coryne, its growth must be rapid. At Pl. IV. fig. 10, I have represented one of the animals extracted from the sac. At this stage its size is much greater than the minute form before described: it now measures $\frac{1}{8}$ inch across. An inspection of the figure will convey a pretty accurate idea of the appearance of the animal. It will be seen that the foot-jaws still retain their advanced state of development, as compared with the other portions, and the rostrum is still short and rudimentary. The foot-jaws were very active, opening and shutting in a highly excited manner, which was perhaps not to be wondered at when we consider the unceremonious way in which it was again introduced into the world. Within the rostrum, near its base, a peculiar pulsating movement is seen; further than this, no motion is discernible.

The larva must have moulted, and got rid of the four rudimentary legs and their filamentous appendages; *for we here see that the young Pycnogon is destitute of legs (not a trace remains), and that the previously described process of the production of these organs by the gradual formation of lobes, to be subsequently elongated into legs, is again seen*: there are now seven such lobes, three at each side and one opposite the rostrum, the latter showing a faint indication of division. The eyes, near the base of the rostrum, are also in course of formation; but at this period they are merely seen as a patch of colour.

Passing onward to a further growth, we come to that stage when the young Pycnogon is found in the sac, with the legs doubled up, as shown at Pl. V. fig. 14. The several organs have now attained a considerable degree of development, and bear a close resemblance to the mature form. Fig. 15 represents the last joints of a leg, with the strong bristles in course of formation. At this stage there is an indication of the young Pycnogon being within a supplementary skin, external to the true skin: this appearance is best seen in the last joints of the legs. The growth of the terminal claw seems a work of time, the deposition of hard material being irregular and unequal.

Having traced, with some slight interruptions, the germs to the larvæ, the larvæ to the immature and parasitical young, we now come to the concluding stages, viz. that period at which the young animal, well developed and furnished with the necessary organs to enable it to provide for itself, seeks an exit from the Coryne-sac or vesicle: here the foot-jaws doubtless play a most important part.

Such sacs as contain well-developed animals are found to be deeply tinged with colour near the summit: if these are selected and kept in clean and cool sea-water, the whole process may be watched. The animal evidently uses its foot-jaws to rupture the investing skin of the sac, which at this stage, from some peculiar circumstance, seems more limp and pliable than at other times. An opening having been effected, one or both of the claws of the first feet are projected through the opening, and, with the usual slow and languid movements of the class, are worked about, doubtless widening the breach; then another leg appears, and another, until the whole animal emerges and sprawls away. If we examine the figure of the free animal as seen shortly after its escape from the sac, it will be noticed that, although closely resembling the mature form in those features that guide us in the discrimination of the species, it nevertheless requires further development. It still has only six legs, the fourth pair being represented by short rounded lobes; these lobes, gradually growing, become jointed, and are furnished with claws and bristles; after which the animal merely requires time to mature its several parts. Whether this is gradual, or assisted by a further moult, I am not prepared to state: it has been seen to perform this process in early life; so it is not improbable that it may do the same in a more advanced stage*.

Finally, I figure a male *Phoxichilidium coccineum*, and also a portion of a female, both fully matured; so that the several stages, from the germs, devoid of organs of any kind, to the perfect animal, may be compared, and their several points of difference and gradual growth be fully understood.

Setting aside for a short space all that has been written on the subject of the anatomy of these animals as bearing upon their

* Since writing the above, I have been so fortunate as to discover the moulted skin of the young *Phoxichilidium* which is cast by the animal before or at the time of leaving the sac of the Coryne: this cast-off membrane is extremely delicate and transparent, and shows the several limbs, &c., from which the animal had withdrawn itself, apparently without much damage to the exuviae. It therefore seems highly probable that the increase of growth in these animals is effected in a similar manner to that of other Crustacea, viz. by a series of moultings. We have seen two instances of this during the embryonic stages, and there is no reason why the process should not continue in after-life.

true position, especially by Quatrefages*, I think, if anything were wanting to show their connexion with the Crustacea, the mere phases in their development would be sufficient to decide the matter, and convince those who wish to remove them from this class of their error.

The teachings of development must ever exercise a powerful voice in classification; and when we see so many instances of the degradation of some animals and elevation of others, in consequence of the increase of our knowledge in this direction, we must all allow that, until we are fully conversant with the life-history of an animal, no matter how profound our other acquaintance with it may be, we have still much to learn. Nearly every animal that we can name possesses some wonderful story which requires unfolding as to its early life; and as our knowledge in this direction is extended, we trace step by step the connexion of one form with another, and prove that forms now regarded by zoologists as fully matured, and therefore described as so many distinct species, are but the varied phases assumed by some one animal during the singular stages of its development. Hence the value of the study of development—that great law of life, everywhere seen and everywhere at work, silent but sure, teeming with beauty, and elevating all who rightly ponder and study the manifold mercies and wisdom of the great Creator who has made so many and such varied forms of life—varied in form, varied in habit, and varied in usefulness, but all showing a marvellous beauty of design and adaptation of form and habits to the several circumstances of their lives.

In conclusion, I have to express my thanks to my esteemed friend the Rev. A. M. Norman for the valuable advice and assistance he has so kindly afforded me during my investigations and in the preparation of this paper.

EXPLANATION OF PLATES.

PLATE IV.

- Fig. 1.* Early appearance of larva of *Phozichilidium coccineum*, removed from ovum attached to female.
- Figs. 2 & 3.* Further stages, showing the early appearance of foot-jaws and rudimentary legs.
- Fig. 4.* Well-developed larval stage, with foot-jaws, rudimentary legs, and their filamentous appendages.
- Fig. 5.* The same, more highly magnified, and showing more distinctly the several parts.
- Fig. 6.* Branch of *Coryne eximia*, with sacs of various forms, and in several of the positions they occupy upon the polypary.
- Fig. 7.* Branch of *C. eximia*, with a sac at the extremity of a stem, and a young polype in course of formation at the extremity of another stem.

* See Quatrefages in 'Annales des Sciences Naturelles.'

Fig. 8. Branch of *C. eximia*, with a sac at the extremity of a stem, which by its position appears to have withdrawn the nutriment from an adjoining part, staying the growth of a shoot, which is seen as a short rounded lobe.

Fig. 9. Branch of *C. eximia*, with a sac at the extremity of a stem.

Fig. 10. Early form of parasitical young, at that period of its existence when it has moulted for the first time and got rid of the rudimentary legs and their appendages, *being now entirely destitute of legs.*

Fig. 11. Further stage, or that period at which it is found free, having effected its escape from the sac.

PLATE V.

Figs. 12 & 13. Portions of females, mature and immature, showing the form and growth of the false feet or "egg-carriers."

Fig. 14. Parasitical young in an advanced stage, and as found doubled up in the sac.

Figs. 15, 16, & 17. Various stages in the development of the claws: viz., 15, whilst within the sac; 16, shortly after escape; and 17, when mature.

Fig. 18. Mature male *Phoxichilidium coccineum*.

X.—*Contributions to British Carcinology.* By the Rev. ALFRED MERLE NORMAN, M.A.

II. *On Species of Ostracoda new to Great Britain.*

Fam. Cypridæ.

Subfam. I. CYPRINÆ (Dana).

Genus CYPRIS (Müller).

Cypris punctillata, n. sp. Pl. II. figs. 11–14.

Forma subovalis; altitudo maxima ante medium sita; margo dorsalis valde arcuatus, ventralis in medio incurvatus. *Forma desuper spectata* ovata, in medio latissima, extremitates versus eodem modo parum attenuata. *Latitudo altitudoque* fere æquales. *Basis* lata, ad extremitates convexa, trans medium impressa atque concava. *Valvarum superficies* undique pilis obsita, cellulisque rotundatis numerosissimis excavata. *Margo valvarum interior* antice et postice latus, lamellosus; lamella sulco profundo excavata; antice et postice aculeis fimbriatus. *Color* saturate viridis. Long. $\frac{7}{80}$ unc.; alt. $\frac{4}{80}$ unc.

Habitat stagna limpida prope Sedgfield in regione Dunelmensi.

Carapace subobovate; dorsal margin boldly arched; ventral margin incurved centrally; the highest part of the valves situated a little before the middle. Surface everywhere clothed with long hairs, and sculptured with closely arranged roundish cells. The superior portion of the anterior extremity is margined with a row of eight spines; and the inferior portion of the posterior extremity in the right valve is margined with about five spines. The lowest of these posterior spines is considerably

larger than the others, and in size and appearance corresponds with a similarly situated tooth in *Cyprideis torosa*, and with that present in the left valve of *Notodramas monacha* (*Cypris monacha*, Baird). Possibly these teeth serve as guides to the right adjustments of the valves, and prevent the margin of the one from overlapping the margin of the other too far when closed.

The form of the carapace, when viewed from above, is ovate; and the valves (which are so tumid that the diameter and height are nearly equal) have their greatest convexity in the centre. The base, or ventral surface, is broad, rounded towards the extremities, but in the centre hollowed out and flattened, giving the carapace a pinched-in appearance at that part. The front and hinder margins are produced internally into broad plates, these plates being channelled by a deep groove.

Colour deep green. Length $\frac{7}{80}$ inch; height $\frac{4}{80}$ inch.

This fine species may perhaps be most readily known by the peculiar pinched-in and flattened surface of the centre of the ventral margin; and this character is evident in all stages of growth. The young, as is usually the case among the *Ostracoda*, have the posterior extremity very much narrower in proportion to the anterior than is the case in more fully developed individuals. The only British *Cypris* which equals the present species in size is *C. clavata* (Baird).

I first found *Cypris punctillata* in the autumn of 1860, in the parish of Sedgfield, co. Durham, in a piece of clear water known as the Forge Dam. It was there associated with *Alona quadrata*; *Peracantha truncata*; *Pleuroxus trigonellus*; *Cypris compressa*, *minuta*, *Westwoodii*, and *bistrigata* (Jurine); *Candona lucens* and *serrata* (Norman); *Cyprideis torosa*, and other more common Entomostraca. During the past summer, I have met with it in extreme abundance in a second habitat—a pond about two miles distant from the first locality, where it lives in company with *Daphnia Schæfferi* and other species.

Cypris aculeata (Lilljeborg). Pl. II. figs. 7–10.

Cypris aculeata, Lilljeborg, om de inom Skane förkom. Crust. af Ord. Cladocera, Ostracoda och Copepoda, p. 117, tab. 11. figs. 15, 16.

Forma brevis et alta, reniformis; margo dorsalis valde arcuatus, ad apicem rotundatum fere in medio situm assurgens; margo ventralis leviter sinuatus. *Forma desuper spectata* elongato-ovata, antice angustior, acuminata. *Latitudo* maxima altitudine multo minor, pone medium sita. *Basis* convexa. *Valvarum superficies* aculeis arcuatis pilisque intermixtis admodum hispida, cellulis numerosissimis excavata. *Color* cæruleo-viridis. Long. $\frac{2}{80}$ unc.

Habitat regionem Dunelmensem prope Sunderland et Stockton.

Carapace reniform, very high in proportion to its length,

covered all over with very numerous cells, and clothed with a hispid covering of intermixed hairs and arched spines. The spines are most evident near the dorsal margin, but there are none fringing the anterior and posterior margins (the only position which spines occupy in the last-described species). The dorsal margin is greatly arched, rising to a rounded summit, which is situated nearly in the centre of the valves: ventral margin slightly incurved centrally.

The form of the carapace, viewed from above, is elongated ovate, slightly narrower in front than behind, and in no part more than slightly convex; so that the height greatly exceeds the diameter. The inferior antennæ have four long and two short slightly plumose filaments. The base is convex.

Colour dark blue-green. Length $\frac{2}{80}$ inch.

Cypris aculeata, now first added to the British fauna, has been well described and figured by Lilljeborg. I received the species, in the early part of the summer, from Mr. G. S. Brady, the friend to whom I am moreover indebted for his most kind assistance in illustrating this paper. Mr. Brady found it in a pond connected with the pumping-engine of the Monkwearmouth Colliery, near Sunderland. The water in this pond is of very variable temperature, but generally sufficiently hot to steam copiously. At the time the species was taken, the water was found by trial to be "over 100° Fahr." This high temperature seemed favourable to the development of Entomostraca; and the luxury of a warm bath was shared by *C. aculeata* with *C. strigata*(?) and *vidua*, *Candona reptans*, *Cyclops quadricornis* and *Daphnia vetula*. Mr. Brady has since taken the species in Hylton Dene, which is also in this county, and remarks that the "specimens from this locality showed the same lively habits, and in the same manner kept generally near the surface, as those from the hot-water reservoir. It seems," he adds, "quite a gregarious species, and swarms upon any little vegetable tuft it may find in a bottle, seeming to avoid the soil as much as possible. It is by far the most active species of the genus that I have seen." It has been found during the autumn in a third locality, by myself, namely, in Cowpen Marshes, near Stockton-on-Tees.

Cypris monstifica, n. sp. Pl. III. figs. 4 & 5.

Forma oblonga; margo dorsalis subrectus, ventralis aliquantum incurvatus; margines antici et postici rotundati; altitudo vix major ante medium. *Forma desuper spectata* maxime irregularis, in medio constricta, hinc utrinque umbones porrecti maximam efficiunt latitudinem; extremitates compressiores. *Valvarum superficies* duobus processibus umbonalibus conspicuis instructa, ex-

tremitatesque versus multis aculeis armata. *Color* arenarius.
Long. vix $\frac{3}{80}$ unc.

Forsitan *Candona*. Animal inspicere non potui; sed, ut naret, dum vivebat nullo modo conatum est.

Aquas habitat limpidas ad Fleckney in regione Leicestrensi.

The valves of this species are oblong, with rounded extremities, their dorsal margin nearly straight, their ventral slightly incurved centrally; the front portion of the valves is slightly higher than the hinder, while the centre, in consequence of the concavity of the ventral margin in that part, is the lowest part of the valves; their surface is very irregular, punctured, elevated at two points (one on either side of the centre) into conspicuous tuberculiform processes, and armed anteriorly and posteriorly with short but strong spines. The form of the carapace, as viewed from above, is narrow in the centre, on either side of which it swells out into the tumid tubercular processes, and then slopes away to subcompressed extremities.

Colour light drab. Length not quite $\frac{3}{80}$ inch.

I have not been able to examine the animal, which possibly may hereafter prove to be a *Candona*. It made no attempt to swim during the day or two it was kept alive in a glass vessel.

Cypris monstifica approaches in outline *Cypris bistrigata* (Jurine), but the sculpturing of the two species is very distinct. It was taken in the canal at Fleckney, in Leicestershire, in August 1856.

Genus CANDONA, Baird.

Candona serrata, n. sp. Pl. II. figs. 1-6.

Forma elongata, aliquantum cuneiformis; margo dorsalis antice valde elevatus, inde ad extremitatem posteriorem descendens; ventralis subrectus; extremitates rotundatæ; altitudo maxima ante medium sita, ita ut antica pars quam postica multo est altior.

Forma desuper spectata compressa; antica pars posticæ æqualis; latitudo maxima mediana. *Valvarum superficies* foveolis impressa sparsisque pilis obsita; ad extremitates inferne aculeis brevibus, crassis, externe directis marginata. *Color* cinereus, macula centrali ovali, atque zona marginali pallidis pictus. Long. $\frac{5}{80}$ unc.; lat. vix $\frac{3}{80}$ unc.

Habitat stagna limpida prope Sedgefield in regione Dunelmensi.

Valves elongated, somewhat cuneiform; dorsal margin greatly raised in front, thence gradually descending to the posterior extremity; ventral margin nearly straight; anterior and posterior margins rounded; point of greatest height situated in front, the hinder portion of the valves being much narrowed. Surface of valves irregularly marked with slightly impressed grooves, and clothed with scattered hairs; lower portions of the anterior and

posterior margins edged with spines, which are short and directed upwards and outwards, and are in number eight to ten in front, and about seven behind. Viewed from above, the carapace is compressed, widest in the middle, and gradually and equally narrower towards the extremities. The height greatly exceeds the breadth. The filaments of the superior antennæ are very long. The ground-colour is an ashy brown painted with a central patch and a marginal zone of a pale buff. Length $\frac{5}{80}$ inch; breadth not quite $\frac{3}{80}$ inch.

Found in extreme abundance among *Zygnema nitidum*, in October 1860, in the Forge Dam at Sedgfield—the same habitat which, as already mentioned, first gave the *Cypris punctillata*. This year the species was comparatively scarce.

It is not without considerable misgivings that I have placed this species provisionally in the genus *Candona*. It undoubtedly belongs to that genus as first constituted by Dr. Baird, and has close relationship with our common species, *Candona reptans*. Prof. Lilljeborg has, however, taken *Candona lucens* as the type of the genus, and having shown that the anatomical features of the former species are inconsistent with those of the latter, has excluded *Candona reptans* from among the *Candonæ*, and inserted it in the genus *Cypris*, of which, together with *Cypris lucida* (Koch) and *Cypris Jurinii* (Zaddach), he has made it a section. This section is characterized by having “the setæ attached to the interior of the third joint of the inferior antennæ short, and not reaching to the apex of the nails of the last joint.” According to Lilljeborg’s arrangement, therefore, the present species would fall into his Section B of the genus *Cypris*. It is not improbable that further observation may point out the expediency of constituting a new genus to receive these intermediate forms. Notwithstanding the length of the filaments of the superior antennæ, the shortness of those of the inferior antennæ render *Candona serrata*, like *Candona reptans*, utterly unable to sustain itself in the water. It is remarkably active, however, on its feet, and runs with great agility.

Subfam. II. CYTHERINÆ (Dana).

Genus CYTHERE (Müller).⁷

Cythere marginata, n. sp. Pl. III. figs. 10–12.

Forma subquadrangulata, antice altior, postice aliquantum humilior, hic rotundata, illic oblique rotundato-truncata; margines ventralis et dorsalis subrecti. *Forma desuper spectata* rhomboides; latera subparallela, ad extremitates subito conniventia. *Latitudo altitudine* aliquantum minor. *Valvarum superficies* rugosa, cellulis ovalibus non profunde impressis sculpta. *Valvarum commissura*

lata, vittam elevatam fingens, processuque triangulari externe conspicuo ad partem cardinis anteriorem instructa. Long. vix $\frac{3}{80}$ unc. *Habitat* fretum, qui Firth of Clyde vocatur, in Scotia occidentali.

Carapace subquadrangular, higher in front; anterior margin obliquely truncate, with rounded corners; the inferior margin produced the furthest; posterior margin rounded; dorsal and ventral margins nearly straight. Surface rough and sculptured with large oval cells. Form, as seen from above, somewhat lozenge-shaped; the sides nearly parallel throughout the greater part of their length, and at the extremities uniting to each other at a considerable angle. The breadth is less than the height, though the carapace is very tumid. The margins of the valves are at their junction raised and flattened into the form of an encircling rib; and the anterior extremity of the hinge is furnished with a triangular process which gives a marked character to the external surface of the valves in that part. The length is not quite $\frac{3}{80}$ inch.

I found this species in 1854, in Lamish Bay, in the Firth of Clyde.

Cythere badia, n. sp. Pl. III. figs. 13-15.

Forma elongata, arcuata; margo dorsalis convexus, ventralis concavus, anticus et posticus rotundatus. *Altitudo* per totam longitudinem fere æqualis. *Forma desuper spectata* subcompressa. *Latitudo* maxima in medio sita, altitudine multo minor. *Valvarum superficies* rugosa, irregulariter sculpta, hic depressa, illic elevata. *Color* badius. Long. $\frac{2}{80}$ unc.

Habitat zonam littoralem ad Penzance in regione Cornubiensi.

Carapace reniform, elongated; dorsal margin much arched; ventral incurved; anterior and posterior margins rounded; height nearly equal throughout the length. Outline, seen from above, subcompressed, broadest in the middle, but the greatest breadth falls very short of the height. Surface of the valves rough and irregularly sculptured with ridges and furrows. Colour chestnut-brown. Length $\frac{2}{80}$ inch.

This is a very small species. Seen under a single lens, it more nearly resembles *C. reniformis* than any other previously described species; but the form is more arched, narrower in proportion to its length, and of more equal height throughout. When looked at with a higher power, the sculpture of the valves, moreover, is found to be entirely different.

I met with this species in rock-pools between tide-marks at Penzance, in May 1855.

Cythere contorta, n. sp. Pl. II. fig. 15.

Forma elongata, fabæformis; margines dorsalis, anticus et posticus arcuati; margo ventralis ante medium valde incurvatus, post medium

subrectus; altitudo maxima pone medium sita. *Forma desuper spectata* compressa, in medio latissima, ad extremitates gradatim æqualiter diminuens. *Latitudo* altitudinis multo minor. *Valvarum superficies* lævis, margaritacea, polita, sparse et minute punctata, zona ciliorum prope marginem sita circumdata. *Color* albidus. Long. vix $\frac{3}{80}$ unc.

Habitat mare ad Berwick in regione Northumbriensi.

Elongated bean-shaped; dorsal, posterior, and anterior margins rounded; ventral margin deeply concave before the middle; the highest part of the valves is towards the posterior extremity. The form, as seen from above, is compressed, the breadth gradually and equally diminishing from the centre to the extremities. The greatest diameter is greatly surpassed by the height. The surface of the valves is smooth, polished, and pearly, merely impressed with a few scattered punctures; encircling the valves at a short distance from their margin, runs a fringe of cilia ranged in single file, which forms a marked characteristic in the species. Colour white. Length not quite $\frac{3}{80}$ inch.

Found among shell-sand at Berwick-on-Tweed, Sept. 1857.

Cythere (Bairdia) inflata, n. sp. Pl. III. figs. 6-8.

Bairdia subdeltoidea, var., T. R. Jones, Entomost. Cretaceous Formation of England, p. 23, and Entom. Tert. Formation, p. 52.

Cythere subdeltoidea, Brit. Mus. Cat. Brit. Crust. p. 108.

Bairdia subdeltoidea, A. White, Pop. Hist. Brit. Crust. p. 293.

Forma ovalis, maxime tumida; margines omnes arcuati; antice aliquantum altior. *Forma desuper spectata* ovalis, in medio lator, ad extremitates paulum diminuens. *Latitudo* altitudinis fere subæquales. *Basis* valde convexa. *Valvarum superficies* omnino lævis, nisi minutissimis punctis subtiliter perforata. *Valvarum commissura* et in ventrali et in dorsali aspectu maxime sinuata. *Color* albus. Long. vix $\frac{4}{80}$ unc.; alt. $\frac{2}{80}$ unc.

Habitat fretum, qui Firth of Clyde vocatur, in Scotia occidentali.

Carapace oval, so tumid in every part as to be nearly cylindrical; all the margins convex; a little lower behind than in front. The form, as seen from above, is oval; the sides very convex, the point of greatest breadth in the centre. The height and breadth are nearly the same. The base is very convex. Surface of the valves very smooth, fine punctures being the only sculpture which the microscope reveals. A marked characteristic of the species consists in the strongly waved line which the junction of the valves presents both on the ventral and dorsal margins. The shell is pure white. Length not quite $\frac{4}{80}$ inch; breadth $\frac{2}{80}$ inch.

Found by myself, in 1854, among shell-sand dredged in Lamlash Bay,—a locality whence Mr. T. Rupert Jones has also procured the species.

Mr. Jones, in his 'Monograph of the Entomostraca of the Cretaceous Formation of England,' has referred the above-described form to his *Bairdia subdeltoidea*, of which he would consider it a variety. I cannot acquiesce in this opinion. The differences between the typical *Bairdia subdeltoidea* and *Cythere (Bairdia) inflata* are so marked that, even were the two forms found living side by side in the same water, I should not hesitate to consider them distinct, unless connecting intermediate forms made it evident that a more than usual latitude must be allowed to the variations in this species. With how much greater reason, then, must we consider them distinct when the two forms are separated from each other not only by the great diversity of structure, but also by the geological æons which have elapsed between the period of the Chalk formation and the present time.

Cythere (Bairdia) mytiloides, n. sp. Pl. III. figs. 1-3.

Forma angusta, elongata, mytiloides (et figura et colore); margo dorsalis arcuatus, ventralis subrectus; antice multo altior, hinc ad extremitatem attenuatam posticam gradatim diminuens. *Forma desuper spectata* compressa, lanceolata, ante medium latior. *Latitudo* altitudine multo minor. *Valvarum superficies* lævis, perpaucis pilis modo obsita. *Valvarum commissura* vix sinuata. *Color* purpureo-badius. Long. circiter $\frac{3}{80}$ unc.

Habitat fretum, qui Firth of Clyde vocatur, in Scotia occidentali.

Carapace narrow and produced, highest in front, and thence tapering gradually to a nearly pointed posterior termination; the ventral margin is nearly straight, and the dorsal margin slopes with a gentle curve to meet it behind. The form, as seen from above, is lanceolate and compressed, the widest part situated before the middle. The breadth is much less than the height. Surface of valves nearly smooth, with merely a few closely appressed hairs, which seem, moreover, to be confined to the hinder part of the shell. The juncture of the valves forms a slightly waved line. Colour purplish brown. Length about $\frac{3}{80}$ inch.

In form, in colour, and in general appearance, this species is very like a young mussel-shell.

Found amongst shell-sand dredged in Lamash Bay, 1854.

Genus CYTHEREIS (Jones).

Cythereis fimbriata (Roemer). Pl. III. fig. 9.

Brit. Mus. Cat. Brit. Crustacea, p. 109.

Cytherina fimbriata, Roemer, Jahrb. (fid. Jones).

Forma oblonga; margo dorsalis concavus, ventralis subarcuatus; margines posticus et anticus oblique truncati, ita ut ventralis margo utrumque versus dorsalem longitudine superat. *Valvarum superfi-*

cies in medio lævis, undique margine elevato circumdata, processibusque linguiformibus, inferne et postice maxime conspicuis fimbriata. *Color* albescens. Long. vix $\frac{4}{80}$ unc.

Habitat fretum, qui Firth of Clyde vocatur, in Scotia occidentali.

Carapace oblong; the dorsal margin concave; ventral margin a little convex, extending beyond the dorsal margin at both extremities; anterior and posterior margins obliquely truncate. Surface of valves smooth in the middle, but surrounded by a raised rim, from whence proceed at various parts, but more especially on the inferior and posterior margins, large flattened linguiform processes. The extremities of the dorsal margin are raised so as to form rounded protuberances. My specimen is whitish in colour, but has a bluish tinge, and may perhaps be bleached. Length not quite $\frac{4}{80}$ inch.

Found by Mr. T. R. Jones at Arran, and by myself among sand dredged off the Isle of Cumbrae, both localities being in the Firth of Clyde.

I have had no opportunity of seeing Roemer's description and figure; and I adopt the name of *Cythereis fimbriata* from the specimen in the British Museum so named by Mr. T. R. Jones.

EXPLANATION OF THE PLATES.

PLATE II.

- Fig. 1. *Candona serrata* (Norman): valvula sinistra, $\times 20$.
 Fig. 2. Eadem, ab imo spectata, $\times 20$.
 Fig. 3. Eadem, desuper spectata, $\times 20$.
 Fig. 4. Eadem: valvularum fragmentum structuram nervosque lucidos ostendens, $\times 100$.
 Fig. 5. Eadem: antenna superior, $\times 100$.
 Fig. 6. Eadem: antenna inferior vel pediformis, $\times 100$.
 Fig. 7. *Cypris aculeata* (Lilljeborg): valvula dextra, $\times 40$.
 Fig. 8. Eadem, desuper spectata, $\times 40$.
 Fig. 9. Eadem, ab imo spectata, $\times 40$.
 Fig. 10. Eadem: fragmentum valvularum structuram, setas spinulasque ostendens, $\times 200$.
 Fig. 11. *Cypris punctillata* (Norman): valvula sinistra, $\times 20$.
 Fig. 12. Eadem, desuper spectata, $\times 20$.
 Fig. 13. Eadem, ab imo spectata, $\times 20$.
 Fig. 14. Eadem: fragmentum valvularum structuram setasque ostendens, $\times 100$.
 Fig. 15. *Cythere contorta* (Norman): valvula dextra, $\times 40$.

PLATE III.

Omnes hujus tabulæ figuræ ad quadraginta diametros auctæ.

- Fig. 1. *Cythere (Bairdia) Mytiloides* (Norman): valvula dextra.
 Fig. 2. Eadem, desuper oblique spectata.
 Fig. 3. Eadem, ab imo oblique spectata.
 Fig. 4. *Cypris monstifica* (Norman), à latere visa.
 Fig. 5. Eadem, ab imo spectata.

Fig. 6. *Cythere (Bairdia) inflata* (Norman): valvula sinistra.

Fig. 7. Eadem, desuper spectata.

Fig. 8. Eadem, ab imo spectata.

Fig. 9. *Cythereis fimbriata* (Römer): valvula sinistra.

Fig. 10. *Cythere marginata* (Norman): valvula sinistra.

Fig. 11. Eadem, desuper spectata.

Fig. 12. Eadem, ab imo spectata.

Fig. 13. *Cythere badia* (Norman): valvula sinistra.

Fig. 14. Eadem, desuper spectata.

Fig. 15. Eadem, ab imo spectata.

Sedgefield, county Durham,
December 6, 1861.

XI.—On new Species of Snakes in the Collection of the British Museum. By Dr. ALBERT GÜNTHER.

[Plates IX. & X.]

AFTER the arrangement of the Collection of Ophidians in the British Museum had been completed (in 1858), it became possible to devote particular attention to the acquisition of such species as were *desiderata* in that Collection. This object has met with great success, not only from the increased number of collections offered for sale, but also from the kind assistance of the keepers of several public collections, who gave up such specimens as were duplicates, and of private gentlemen who had become interested in the subject. Among the former we must mention Th. J. Moore, Esq., of the Liverpool Museum; Prof. Aitken, Curator of the Museum of the medical officers at Fort Pitt; Prof. Peters of Berlin; and finally, the officers of the Smithsonian Institution: of the latter, G. Krefft, Esq. (Sidney); O. Salvin, Esq.; Dr. O. Wucherer; Capt. R. H. Beddome; Ch. N. Buller, Esq.; J. H. Gurney, Esq.; O. Russell, Esq.; Consul Swinhoe, &c.

It would require the space of a supplementary catalogue to enumerate all the new accessions to the Collection in the course of the last three years; it must suffice here to give only a list of those species which had been *desiderata*, and of those which were new to science and have been described from Museum specimens. It will be seen, from the lists appended, that 100 species have been added to the Collection.

The Collection of Snakes in the British Museum contains now 611 species, and the typical specimens of 184 of them.

I. List of Species which were formerly *desiderata*.

**Loxocemus bicolor*, Cope. G. Lenox Conyngham, Esq.
Wenona plumbea, B. & G. California. Smiths. Instit.
Rhinophis oxyrhynchus, Schn. Ceylon. Purchased.

- Rhinophis homolepis, *Hempr.* Ceylon. Purchased.
 — Blythii, *Kelaart.* Ceylon. Ch. R. Buller, Esq.
 Plectrurus Perrotetii, *D. & B.* Anamallay Hills. Capt. R. H. Beddome.
 Catostoma chalybæum, *Wagl.* Mexico. Purchased.
 Colobognathus Hoffmanni, *Pet.* Costa Rica. Prof. Peters.
 Geophidium dubium, *Pet.* Mexico. Purchased.
 Stenorhina Degenhardtii, *Berth.* Mexico. Purchased.
 Homalocranium atrocinctum, *D. & B.* Guatemala. O. Salvin, Esq.
 — gracile, *Hallow.* Texas. Smiths. Inst.
 Simotes trinotatus, *D. & B.* Siam. Purchased.
 Tomodon lateralis, *D. & B.* Mexico. Purchased.
 Coronella Boylii, *B. & G.* California. Smiths. Inst.
 Pliocercus Deppei, *Pet.* Mexico. Purchased.
 Tropidonotus platyceps, *Blyth.* Himalaya. E. I. Museum.
 — monticola, *Jerd.* Anamallay Hills. Capt. R. H. Beddome.
 Heterodon semicinctus, *D. & B.* Fort Pitt Museum.
 Herpeton tentaculatum, *Lacép.* Siam. Purchased.
 Hydrodipsas elapiformis, *Pet.* Purchased.
 Pituophis Sayi, *Schleg.* N. America. Purchased.
 Coluber Evansii, *Kennic.* Missouri. Smiths. Inst.
 Cynophis malabaricus, *Jerd.* Anamallay Hills. Capt. R. H. Beddome.
 Spilotes alleghaniensis, *Holbr.* Illinois. O. Russell, Esq.
 — samarensis, *Pet.* Philippines. Purchased.
 Zamenis mexicanus, *D. & B.* Mexico. Purchased.
 Bascanion vetustus, *B. & G.* Oregon. Smiths. Inst.
 Herpetodryas quadrilineatus, *D. & B.* Madagascar. Purchased.
 Philodryas serra, *Schleg.* South America. Liverpool Museum.
 Dromicus leucomelas, *D. & B.** S. Domingo. Purchased.
 (Tropidonotus?) seychellensis, *Schleg.* Seychelles. Purchased.
 Langaha crista-galli, *D. & B.* Madagascar. Purchased.
 Dipsas Drapiezii†, *Boie.* Java. E. I. Museum.
 Dipsas (Vipera) bubalina, *Klein.* East Indies. A. Günther.
 Hormonotus modestus, *Schleg.* (= H. audax, *Hallow.*). West Africa. Purchased.
 Oxyrhopus scolopax, *Klein* (= O. doliatus, *Gthr.*, not *D. B.*). South America. Purchased.
 Tetragonosoma effrene, *Cant.* Pinang. E. I. Museum.
 Diemansia Kubingii‡, *Jan.* Sidney. G. Krefft, Esq.
 Pseudonaja textilis, *D. & B.* Australia. Purchased.
 Callophis trimaculata, *Daud.* Tenasserim. Dr. Russell.
 Elaps semipartitus, *D. & B.* South America. Purchased.
 — decoratus, *Jan.* Brazil. Purchased.

* My supposition that this snake is identical with *D. ater* has proved to be quite incorrect. (Col. Snak. p. 127.)

† The specimen formerly referred to this species is different, but in so bad a condition that its determination is almost impossible. The diagnosis of the species (Col. Snak. p. 171) is partly incorrect, there being a series of white spots along each side of the belly, and not of black ones. The lateral edges of the vertical are convergent.

‡ Frontals sometimes united into a single pair.

Naja nigricollis, *Reinh.* West Africa. Purchased.
Atropus undulatus, *Jan.* Mexico. Purchased.
Crotalophorus tergeminus, *Say.* Illinois. Smiths. Inst.
Crotalus confluentus, *Say.* Nebraska. Smiths. Inst.
Cerastes rhinoceros, *Schleg.* West Africa. Purchased.

II. List of the new Species procured from 1858 to 1861.

Chrysenis Batesii. Brazil. Purchased.
Pelophilus Fordii. West Africa. Purchased.
Rhinophis planiceps, *Pet.* Ceylon. Ch. R. Buller, Esq.
 — *melanogaster*. Ceylon. Purchased.
Silybura macrolepis, *Pet.* Ceylon. Purchased.
 * — *brevis*. Anamallay Hills. Capt. R. H. Beddome.
 * — *Beddomii*. Anamallay Hills. Capt. R. H. Beddome.
Geophis Güntheri, *Wuch.* Bahia. Dr. O. Wucherer.
 * *Elapomorphus mexicanus*. Mexico. Purchased.
 — *scalaris*. Bahia. Dr. O. Wucherer.
 — *Wuchereri*. Bahia. Dr. O. Wucherer.
Elapops modestus. West Africa. Purchased.
Uriechis microlepidotus. East Africa. J. H. Gurney, Esq.
Homalocranium laticeps. Carthagera. Capt. Garth.
 * *Oligodon Templetonii*. Ceylon. R. Templeton, Esq.
 * — *affinis*. Anamallay Hills. Capt. R. H. Beddome.
 * — *brevicauda*. Anamallay Hills. Capt. R. H. Beddome.
Simotes tæniatus. Siam. Purchased.
Ablabes Rappii. Himalayas. E. I. Museum.
 — *Owenii*. Himalayas. E. I. Museum.
Coronella brevis. Island off Mogador. Rev. R. T. Lowe.
Pliocercus æqualis, *Salv.* Guatemala. O. Salvin, Esq.
 * *Liophis viridis*. Pernambuco. Purchased.
Mizodon bitorquatus. West Africa. Purchased.
 — *Dumerilii*. West Africa. Purchased.
 * *Tropidonotus orientalis*. China. Consul Swinhoe.
 * *Natrix lævissima*. Fort Pitt Museum.
Helicops modestus. South America. Purchased.
 — *polylepis*. Upper Amazon. Purchased.
Spilotes Hodgsonii. Himalayas. E. I. Museum.
 * — *Salvini*. Guatemala. O. Salvin, Esq.
 * *Zamenis gracilis*. Kurrachee. Fort Pitt Museum.
Coryphodon rhombifer. Esmeraldas. Purchased.
 * *Psammophis tæniata*. East Indies. Old Collection.
 * *Hydrophobus semifasciatus*. T. C. Eyton, Esq.
Herpetorcas Sieboldii. Himalayas. E. I. Museum.
Herpetodryas biserialis. Galapagos Islands. Old Collection.
 * *Philodryas Reinhardtii*. Bahia. Dr. O. Wucherer.
 * *Dromicus mentalis*. West Indies. Purchased.
 * *Rhamnophis æthiopissa*. West Africa. Purchased.
Ahætulla occidentalis. Ecuador. Purchased.
Leptodira torquata. Nicaragua. Liverpool Museum.

Leptodira discolor. Mexico. Purchased.

**Diemansia cucullata*. Sidney. G. Krefft, Esq.

*—— *torquata*. Norfolk Island. Purchased.

**Hoplocephalus temporalis*. South Australia. Purchased.

*—— *nigrescens*. Sidney. G. Krefft, Esq.

**Callophis nigrescens*. East Indies. Fort Pitt Museum.

Elaps filiformis. Para. Purchased.

Trimesurus macrolepis, *Bedd.* Anamallay Hills. Capt. R. H. Beddome.

Thamnocenchris aurifer, *Salv.* Guatemala. O. Salvin, Esq.

Lachesis nitidus. Ecuador. Purchased.

Nearly all the species named have been described in the 'Proceedings of the Zoological Society' or in this Journal; and I subjoin here the descriptions of, or remarks on, those marked with an asterisk (*).

Loxocemus bicolor, Cope, Proc. Acad. Nat. Sc. Philad. 1861,
p. 76*.

The discovery of this snake is one of the most important additions to herpetology made in the course of the last few years. I had been in doubt for some time as regards the position which this highly interesting form should take in the system, when I received Mr. Cope's excellent description of it. The specimen in the British Museum is in very good condition, 18 inches long (we are not acquainted with the size of the specimen in the Smithsonian Museum), and agrees with Mr. Cope's description so well that we cannot doubt the specific identity of the two specimens. Only two points deserve some remarks. First, the intermaxillary teeth are present; there are two, smaller than the

* In the same part of the Journal quoted (p. 74) Mr. Cope has pointed out the identity of *Ablabes purpureocauda*, Gthr., with *Contia mitis*, Baird & Gir., and of *Tropidonotus medusa*, Gthr., with *Regina Clarkii*, Baird & Gir. I have no doubt that this observation is fully correct; but I feel rather surprised that the identity of those species should have been "suggested" by one of the authors of the 'Catalogue of North American Reptiles.' Those authors have considered the number of scales (21, 19, 17) as a character of sufficient importance, not only for distinguishing the species, but also for dividing them into separate groups (see *Eutainia*); they have founded a new genus (*Contia*) on the presence of a single post-orbital, and distinguished it by that character from *Chlorosoma* (Baird & Gir. Cat. pp. x. 110). Now, when Prof. Baird suggests that a snake with 21 series of scales, and with quite a peculiar coloration of the belly (*T. medusa*), is identical with another with 19 series, and with a different coloration (*T. Clarkii*), and that specimens with two post-orbitals (*A. purpureocauda*) ought to be referred to a genus expressly distinguished from a second genus by the character of one post-orbital (*Contia*), he confesses that his views about specific and generic characters in Ophidians have undergone a considerable change since the publication of his Catalogue, or he must admit that it is impossible to determine from the accounts of the said Catalogue those species which he so readily recognized in my descriptions.

front teeth of the maxillary, on the left side of the intermaxillary, whence I have removed the soft parts. Secondly, our specimen does not show any trace of the external anal spur, or of the internal rudiments of a posterior extremity. I am not inclined to put any value on the presence or absence of those rudimentary limbs; and, considering how closely the British Museum specimen agrees with Mr. Cope's description, I do not believe that it can belong to a distinct species. The presence of intermaxillary teeth, and the occurrence of rudimentary limbs in certain individuals, leave no doubt that this genus is to be placed near or with the Pythonidæ, as has been indicated by Mr. Cope. It differs from all the genera of this family by the shields of the head, and approaches several genera of Homalopsidæ with regard to its physiognomy.

The locality where our specimen was procured is not known: it was presented together with two specimens of *Geophis maculata*.

Silybura brevis.

Scales in 17 rows, on the neck in 19; ventral shields 122, anal bifid, subcaudals 9. Snout obtuse; rostral shield rounded; caudal disk well defined, nearly as long as the tail, each scale with two strong keels; the disk terminates in two horny horizontal points. Body short, the circumference of the anterior third of the trunk being contained six times and a half in the total length. Upper parts brown; the lower part of the sides and the belly yellowish, densely marbled with brown; sides of the throat yellowish, immaculate; the lower part of the tail black, with a broad white band on each side. Total length 66 lines; length of the head 3 lines, of the tail $3\frac{1}{2}$ lines; circumference of the anterior part of the trunk 10 lines.

One specimen from the collection of Capt. R. II. Beddome, made in the Anamallay Hills.

This species differs from *S. ceylonica* by its very short body and much more obtuse snout.

Silybura Beddomii.

Scales in 17 rows, on the neck in 19; ventral shields 178, anal bifid, subcaudals 5 to 6. Snout pointed; rostral shield conically protruding, its posterior portion compressed into a slight ridge, far produced backwards, but separated from the frontal shields by the nasals. Caudal disk slightly convex, not well defined, nearly as long as the tail, with two or three strong keels on each scale; the disk terminates in a broad, horny, bicuspid, horizontal scale. Body elongate, the circumference of the thickest part of the anterior third of the trunk being one-eleventh of the total length. Brown; each ventral shield and each scale

on the sides with a white dot; a yellowish line on each side of the neck; commencing from the last upper labial; vent and tip of the tail yellow. Total length 132 lines, head 3 lines, tail 4 lines; circumference $11\frac{1}{2}$ lines.

Three specimens of equal size were found by Capt. R. H. Beddome in the Anamallay Hills.

Elapomorphus mexicanus. Pl. IX. fig. 1.

Allied to *E. Blumii*, Wieg. (= *Elapocephalus taniatus*, Gthr.). Scales in 15 rows; a pair of anterior and posterior frontals; 7 upper labials. Brownish olive, with three blackish longitudinal bands: viz. one, almost linear, along the vertebral series of scales; the two others along the sides, each composed of two blackish lines, one line running along the middle of the second outer series, the other along that of the third. A pair of small yellowish spots on the neck; a yellowish band across the front part of the snout; lips with a black spot below the eye; lower parts uniform yellowish.

Habit moderately slender. Anterior frontals broad, but very short, their longitudinal diameter being only one-fourth of that of the posterior; vertical six-sided, of moderate length; occipitals not much longer than vertical. Posterior frontal in contact with the second labial; one anterior ocular, not reaching to the upper surface of the head; two post-oculars. Seven upper labials, the third and fourth of which enter the orbit, the seventh being the largest. A rather large temporal shield in contact with the post-oculars; a small one behind, between the eleventh labial and the occipital. The median lower labial is exceedingly small; the first pair of lower labials are narrow, transverse, and form a suture together; two pairs of chin-shields of nearly equal size. Scales without apical groove. Ventral shields 158; anal bifid; subcaudals 52. Length of head 4 lines, of trunk 10 inches, of tail 2 inches 9 lines. Mexico.

Oligodon Templetonii.

Habit moderately slender. Scales in 15 rows; loreal distinct. Head uniform above, laterally with the markings usually found in the genus. Body brownish, with a light vertebral band, which becomes more distinct on the tail, and is crossed by oblique, narrow, dark-brown bands. Belly white (in spirits), chequered with black, the black and white being distributed in nearly equal proportions. 135 ventral, 1 bifid anal, 31 subcaudal shields. Ceylon.

This species is allied to *O. subquadratus*; the first specimen of it has been brought home by Dr. R. Templeton.

Oligodon affinis.

Habit stout. Scales in 17 rows; loreal none, united with post-frontal. Head with the markings usually found in the genus. Body brownish grey; anterior part of the back with short, narrow, black transverse streaks. Belly white, with black subquadrangular spots, the black and white being divided in nearly equal proportions. 134 ventral, 1 bifid anal, 25 subcaudal shields.

Found by Capt. R. H. Beddome in the Anamallay Hills.

Oligodon brevicauda.

Allied to *O. dorsalis*, but with very singular characters. Only one pair of frontals; rostral thick, broad, reaching far backwards. Scales in 15 rows; loreal none. Greyish violet. Head with the markings usual in the genus; a broad blackish collar. A band along the vertebral line, indistinct anteriorly, light greyish on the middle of the body, becoming pure white posteriorly and on the tail; it is bordered anteriorly by a series of pairs of equidistant blackish spots; there are no black spots on the tail interrupting the dorsal band. A blackish longitudinal streak on each side, along the third outer series of scales. Ground-colour of belly the same as of the upper parts, with black quadrangular spots; subcaudals whitish. 172 ventral, 1 bifid anal, 30 subcaudal shields. Anamallay Hills.

Coronella brevis.

Closely allied to *C. girundica* and *C. cucullata*. Scales in twenty-three rows; upper labials eight; anal bifid. Brownish olive; on each side of the occiput a dark spot, a dark collar behind; an oblique brownish streak below the eye. Belly uniform white. Body stout and short. *Hinder maxillary tooth grooved.*

Discovered by the Rev. R. T. Lowe on the small Island (without name) off the coast of Mogador.

Liophis viridis. Pl. IX. fig. 2.

Habit rather slender. Scales smooth, without groove, in 19 rows. Head rather depressed; shields of head regular and proportionate; vertical with the lateral margins convergent; rostral broader than high; loreal square; one anterior ocular reaching to the upper surface of the head; two posterior oculars; eight upper labials, the fourth and fifth entering the orbit; one elongate anterior temporal, in contact with the two oculars; two small temporals behind; six pairs of the lower labials in contact with the chin-shields; two pairs of chin-shields, the anterior much larger than the posterior. Ventrals 178; anal

bifid; subcaudals 66. Posterior maxillary tooth elongate, separated from the others by an interspace. Upper parts uniform blue (in spirits), probably greenish olive in life; the lower uniform white.

Two specimens have been received,—one from Pernambuco.

This species differs from *Coronella Jageri* by its depressed head, by the form of its vertical shield, and by its isolated posterior maxillary tooth; from *Xenodon typhlus* by a much more slender habit, a specimen of the same length as one of the latter species having only half as large a head. *X. typhlus* has 140–147 ventral shields, and no grooves on the scales.

Length of head $\frac{1}{2}$ inch, of trunk 18 inches, of tail $4\frac{1}{2}$ inches; greatest circumference of the trunk 14 lines,—whilst the circumference of the trunk of a *X. typhlus* of the same total length (22 inches) is 23 lines.

Tropidonotus orientalis. Pl. IX. fig. 3.

Intermediate between *T. natrix* and *T. hydrus*.

Scales in 19 rows, strongly keeled; upper labials seven, the third and fourth entering the orbit; two anterior and three or four posterior oculars; anterior frontals not pointed, rather obtuse in front. Greenish olive, with three series of black spots anteriorly, becoming very indistinct on the middle of the trunk; a black suberescentic spot on each side of the neck, without yellow; posterior margins of the upper labials and a spot on the temple black. Belly more or less blackish. Three temporal shields, the anterior of which is the largest, in contact with two oculars. Ventral shields 152, anal bifid; subcaudals 64.

Two specimens, an adult and a young one, were sent by Consul Swinhoe from Northern China, together with specimens of *Elaphis dione*.

[To be continued.]

BIBLIOGRAPHICAL NOTICES.

General Outline of the Organization of the Animal Kingdom, and Manual of Comparative Anatomy. By THOMAS RYMER JONES, F.R.S., &c. &c. Third Edition. 8vo. London: Van Voorst, 1861.

It is with great pleasure that we have to announce to our readers the appearance of a third and greatly improved edition of Professor Rymer Jones's 'Animal Kingdom.' The fact that a new edition has been so soon called for, considering the scope and character of the book, is of itself a sufficient evidence of its intrinsic value; and although, in our notice of the second edition, we felt bound to point out what appeared to us certain defects in the work, we were

quite prepared, from its general excellence, to expect for it a widely extended popularity. We are glad to see that in the present edition those errors and omissions of greater or less importance which were indicated in its predecessor have been rectified and supplied, and that the author has likewise cast off certain relics of an antiquated system to which we particularly directed attention.

As Professor Jones's volume professes to be an outline of the "organization" of animals, he might perhaps claim to be to a certain extent exempt from criticism in respect of his system; but inasmuch as it is a Manual of Comparative Anatomy and Physiology, and the anatomical statements are to be regarded as illustrative of groups rather than individual species, the classification adopted by the author becomes a matter of primary importance; and we took occasion to object, in our notice of the second edition, to the retention of certain groups in certain positions, as having a tendency to confuse the notions of students upon points of high interest in zoology.

In the volume before us, however, nearly all this is changed: the Epizoa, instead of occupying their old anomalous position amongst the Radiata, have been transferred to their true place in the class Crustacea, and have been accompanied in their flight by their old neighbours the Rotifera, which, however, still of course retain the rank of a class; the Cirrhopoda, which Professor Rymer Jones persisted in 1855 in regarding as Molluscan, are likewise transferred to the Annulose series, but (we think) erroneously kept distinct from the Crustacea. Lastly, the Bryozoa have also made their way from their former low position, to take the place which is now almost universally assigned to them amongst the Mollusca. Curiously enough, however, our author has hesitated to adopt another change which appears to us equally warranted with those just mentioned, namely, the transfer of the Entozoa, or Helminthozoa as he now calls them (including, moreover, the *Turbellaria*), to the division of Annulose animals; and probably the extreme supporters of the new school of zoology may think that he would have been equally justified in removing the Echinodermata into the same series. We are not, however, prepared to cavil at the omission of this change, as we hold it to be the duty of the author of any student's manual of science not so much to give his own peculiar and perhaps still problematical views upon any given point, as to bring his general treatment of his subject as much as possible into accordance with the most generally received opinions. In this, with the single exception of the omission of the Helminthozoa, Professor Jones appears to us to have admirably succeeded as far as regards the three higher subkingdoms, to which he gives the names of Homogangliata, Heterogangliata, and Vertebrata; but we think it a pity that he has not followed the same course with the lower forms. Feeling, perhaps, a distrust of the results obtained by some of our more advanced zoologists, and desiring, as he himself says, to avoid unnecessary changes in zoological classification, our author, whilst advancing a certain distance on the route traced by Professors Huxley and Leuckart and followed by Professor Greene in his excellent manual of the Coelenterata, and

accepting the division of the gelatinous Radiata into the two classes of Hydrozoa and Anthozoa, has nevertheless retained the group of Acalephæ in its entirety, as including the *Medusæ* (both naked- and covered-eyed), the *Ctenophora*, and the *Siphonophora*; and, as far as his book is concerned, we find no indication of the arrangement of the animals below the Annulosa into one or more subkingdoms. This we cannot but look upon as a defect; and we also regret to see the term Protozoa applied only to the Sponges and Rhizopoda as distinguished from the Infusoria.

Having thus stated the few objections which we have to make against the new edition of Professor Rymer Jones' work, we may proceed to the more pleasing task of saying a few words in its praise. Besides the important changes in system already adverted to, we may notice the great care and industry displayed by the author in bringing together the more important results of the recent researches of comparative anatomists and physiologists, and the skill with which he has incorporated his new matter with the exceedingly elegant text of the former edition, which is probably familiar to most of our readers. The typographical execution of the work, and the beauty of the woodcuts, the number of which is increased by the addition of several new and important figures, also call for all praise; and it may safely be said that we have no treatise on Comparative Anatomy, in the English language, that can at all compare with it.

Sketches of the Natural History of Ceylon, with narratives and anecdotes illustrative of the habits and instincts of the Mammalia, Birds, Reptiles, Fishes, Insects, &c., including a Monograph of the Elephant and a description of the modes of capturing and training it. By Sir J. EMERSON TENNENT, K.C.S., LL.D. Small 8vo. London, 1861. Longmans.

As this work consists chiefly of an enlarged reproduction of the Zoological chapters of Sir James Tennent's general description of Ceylon, which we noticed at some length in this Journal (Annals, December 1859) at the time of its appearance, we need do little more than call our readers' attention to the fact of its publication. The author tells us that in preparing his former work for the press he found it necessary to curtail the zoological chapters somewhat, as they would otherwise "have encroached unduly on the space required for other essential topics." In his 'Natural History of Ceylon' he has restored the suppressed passages, consisting to a great extent of anecdotes illustrating the habits of the animals described, and he has also taken the opportunity of introducing some fresh materials. The volume also contains the Treatise on the Elephant, which formed part of the second volume of the larger work; and into this we notice that the author has introduced several fresh anecdotes and remarks.

Next in importance and interest to the chapters on the Elephant are those on the Reptiles and Fishes of Ceylon, the latter being par-

ticularly interesting from the curious observations recorded on what we may call the terrestrial life of Fishes. The list of Fishes, drawn up principally by Dr. Günther, and the remarks of Professor Huxley and Dr. Gray on the richness of the Fish-fauna of the Ceylonese seas, and its comparison with that of other regions, are also exceedingly valuable and suggestive. With the invertebrate animals Sir James Tennent seems to be less familiar; but even upon these we find many interesting observations, and each chapter is furnished, by way of appendix, with a list of the species of the group treated of, known to inhabit Ceylon. These lists, although confessedly imperfect, will be, even as they stand, of great advantage to the student of zoological geography, whilst to those who may hereafter take up the investigation of the Natural History of Ceylon they will afford a most valuable aid.

A History of British Sessile-eyed Crustacea. By C. SPENCE BATE, F.L.S., and J. O. WESTWOOD, M.A., F.L.S. &c. 8vo. London: Van Voorst, 1861. Parts 1-3.

Of two great sections of the class Crustacea the British species have already been admirably elucidated—the Podophthalmous forms by Professor Bell, and the Eutomotraca by Dr. Baird. The abnormal forms constituting the group of Cirripeds, which may perhaps with some justice be ranked among the latter, have also received their due share of attention in Mr. Darwin's classical work published by the Ray Society; but there still remains a vast number of species, forming the group Edriophthalma of Latreille, to the arrangement and discrimination of which the British naturalist possesses no other guide than is afforded by Mr. Spence Bate's "Synopsis" published in this Journal (February 1857), and Mr. White's excellent little 'Popular History of British Crustacea.' Under these circumstances we welcome with no common interest the appearance of the work of which the first three parts are now before us, in which Mr. Spence Bate, whose acquaintance with his subject no one can doubt, has called to his aid the artistic talents and great general knowledge of the Articulata possessed by the distinguished Hope Professor at Oxford; and, from the care with which the text of their joint production has evidently been prepared, there now appears every prospect of our soon possessing in a moderate compass a complete description of the British Crustacea. No doubt the numerous species, especially of Eutomotraca, which have been discovered in our waters since the publication of the works alluded to at the commencement of this notice, render a revision of them desirable; but in the meanwhile the student of Crustacea will be able to advance far upon his course of investigation with the aids already in his hands.

The classification adopted in the work now under consideration agrees with that given by Mr. Spence Bate in his "Synopsis" of the Amphipoda already referred to; that is to say, he suppresses the order Læmodipoda altogether, and divides the Edriophthalma into the two great orders Amphipoda and Isopoda. The former of these

groups he regards as analogous to the Macrura, and the latter to the Brachyura, whilst the Læmndipoda of Latreille are treated as aberrant Amphipods parallel to the *Squilla* amongst the Podophthalma.

In the introductory description of the general characters of Amphipods, our authors give an explanation of the somewhat cumbrous terminology proposed by Mr. Spence Bate for these animals. We cannot but regard it as a drawback upon the efforts of our living zoologists that scarcely one of them produces a work at all monographic in its nature without the introduction of a host of new terms, which, although they may to a certain extent conduce both to accuracy of language and brevity of description, are still so many obstacles to be got over by the student before he can really make use of the aid afforded him. This, however, is but a minor point; and we gladly pass to the consideration of those characteristics of the book which call for unqualified approval. These consist, on the one hand, in the fulness of the synonymy, the clearness with which the characters and descriptions have been drawn up, and the care with which the British localities for each species are brought together; and on the other, in the admirably executed figures with which Professor Westwood has illustrated the species. The latter consist of finished outlines of the animals, accompanied by numerous magnified figures of characteristic details; and although from their nature necessarily inferior in elegance to many of the woodcuts with which we are familiar in Mr. Van Voorst's publications, they will be found of equal or perhaps greater scientific value. The tail-pieces appended to several of the articles fully maintain the reputation acquired by others in Mr. Van Voorst's series: they are chiefly small views of localities interesting to the British zoologist from their being associated with the labours of those whose names, with him, are as household words.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

June 25, 1861.—Dr. J. E. Gray, F.R.S., V.P., in the Chair.

The following extract was read from a letter, dated Sydney, April 19th, addressed by Dr. G. Bennett, F.Z.S., to the Secretary:—

“You will recollect I mentioned in my ‘Gatherings’ a specimen of the Semipalmated Goose (*Anseranas melanoleuca*). That bird I found on my return to Sydney alive and well; and it has been presented to me by its owner, Mr. Clarke. In the young bird the legs and mandibles were flesh-colour; in the adult they are of a light reddish-orange colour, except the horny tip of the mandibles, which was of a light-blue colour. The black and white plumage—the former colour predominating—imparts to the bird a very handsome appearance as it walks with a stately tread (not with the waddling gait of the goose) about the yard of my house like one of the Waders. I have, however, from ignorance of its natural habits been the pro-

bable cause of the death of this bird, and I send you the following remarks, considering they may be of some service to those desirous of domesticating them. This bird was reared from the egg hatched under a common hen, and has survived nearly four years and a half domesticated in daily amicable intercourse with ducks, geese, and all kinds of poultry, and always appearing playful and happy in their society. But it unfortunately happened that, when sent to me, I was not aware of its aversion to a solitary life. When alone in the yard I noticed that it did not eat. Fearing that it had not its usual food, I made inquiry, but found that it had its accustomed food. Still, however, it moped, and more frequently than usual made its peculiar clanging noise; and although it would walk about the yard, yet it more frequently mounted the high flight of stone steps and squatted upon the lofty wall, remaining there for the most part of the day. Although it did not feed well, yet it would often wash itself in a tub of water placed for its use, and drank a good deal of water. At last it became ragged in plumage, the wings drooped, and it died after having been in my possession only from the 28th of February to the 25th of March. On mentioning the circumstance to a relation of the donor, I was then informed, but too late, that if kept by itself it would droop and refuse food, but when placed among other fowls became lively, playful, and fed well. I fear that many birds and other animals perish in our menageries by inattention to these apparently trivial circumstances, which are, however, most essential to their successful rearing and preservation. I have been informed, by those who have eaten of these birds in the southern parts of Australia, that they are usually thin, and the flesh coarse and not well-flavoured."

NOTES ON THE BROAD-FRONTED WOMBAT OF SOUTH AUSTRALIA
(*PHASCOLOMYS LATIFRONS*, OWEN). BY GEORGE FRENCH
ANGAS, CORRESPONDING MEMBER OF THE ZOOLOGICAL
SOCIETY OF LONDON, ETC.

The existence of a second species of *Phascolomys* on the Australian continent was established some years ago by Professor Owen, from a skull sent to England from South Australia, and named by him *Phascolomys latifrons* (see 'Proceedings of the Zoological Society' for 1845).

Mr. G. R. Waterhouse, in his excellent work on the *Marsupialia*, says, "Of the Broad-fronted Wombat, all that is known is a skull sent from South Australia to Professor Owen. This skull presents so many marked differences when compared with that of the *Phascolomys Wombat*, that no doubt can be entertained of the existence of two distinct species of Wombats."

I have lately had the opportunity of examining a full-grown male example of the Broad-fronted Wombat, now living in the Botanical Gardens in Adelaide, and of comparing it with two adult specimens (male and female) of the Tasmanian Wombat, which, fortunately enough, were being exhibited at the time in Adelaide. The differ-

ences between the two species were so evident, that I was induced to make a careful drawing of *P. latifrons*, which, together with my observations and measurements of both animals, I have much pleasure in laying before the Society.

When I first saw the Wombat in the Adelaide Gardens I was at once impressed with the idea that it was an animal altogether distinct from that figured by Mr. Gould in his 'Mammals of Australia;' but as I was unable to refer to a copy of that magnificent work in this colony, I hailed with pleasure the arrival of the living Tasmanian Wombats, an inspection of which set aside all my doubts as to the distinctness of the two species.

Phascolomys latifrons, Owen. Adult male. Total length 38 inches. Fur fine and silky, rather long, particularly on the hind-quarters; colour light silvery mouse, tinged with buff and purplish brown, browner on the face; the chest is white; the remainder of the under surface is of a reddish mouse-colour; the feet are of the same colour as the body; the claws are smaller than those of *P. Wombat*; the toes are covered with hair to the nails; under lip blackish; there is a light-coloured spot above the eye, and a corresponding one below it, with a dark triangular patch extending underneath the eyes in front towards the nostrils; eyes small, irides dark hazel; eyelids black; nose flesh-coloured; the bristles of the eyebrows are black and rather long, as are also those in the centre of the cheek and round the nostrils; tail naked and very small; the hind quarters present somewhat of that peculiarly flattened or truncated appearance observable in the ordinary Wombat; the ears are well-clothed with hair internally. The following are the dimensions of *P. latifrons*:—

	in.	lin.
Length from tip of nose to root of tail	37	0
— of tail	1	0
— of head	10	0
— of ear	3	8
Breadth between tips of ears	8	0
— between root of ears	5	0
— between eyes	3	0
Girth of skull in thickest part	18	0
— of centre of body	28	4
Length of hind foot, including claws	4	4
— of fore foot	3	3
Height at shoulder	12	0
— at hips	14	0
Length of hind claw $\frac{1}{2}$ an inch; fore claw . .	1	0

Phascolomys Wombat, Péron et Lesueur. Adult male. Total length 33 inches. Fur very rough and coarse, of a dark grizzly-grey; ears quite small, blackish brown outside, whitish internally; nose nearly black, and more pointed than that of *P. latifrons*, giving to the face an expression slightly resembling the "Koala" (*Phascolarctos cinereus*); whereas the *P. latifrons* presents a bold, bull-dog-like aspect from the greater expansion of his face and width of

nostrils ; the tail is naked and rudimentary ; the feet are black, as are the hairs of the fur covering them above ; the claws are black, and are longer and more powerful than those of *P. latifrons*. The general aspect of *P. Wombat* is more bear-like than that of *P. latifrons*. In standing it arches its back considerably, and does not hold its head so erect as the latter animal ; the expression of the eye, too, is decidedly fierce, and lacks the good-natured twinkle of the South Australian species. Next to the form of the skull, one of the most striking specific differences manifests itself in the colour, character, and texture of the fur ; in sleeping it rolls itself almost into a ball, burying its nose between its fore paws. The measurements I made of the adult male of the *P. Wombat* are as follows :—

	in.	lin.
Extreme length	33	0
Length of head	9	0
Breadth between tips of ears	6	9
Breadth between eyes	3	0
Length of ears	2	0
Girth round centre of body	29	6
Height, middle of back	15	0

The specimen of *P. latifrons* in the Adelaide Botanical Gardens is the only one I have yet seen. It was caught some twelve months since, near the Gawler River, about thirty miles north of Adelaide. It is kept in an enclosure, where it is secured with a strong chain and collar to prevent its escape by burrowing ; it is perfectly docile, and never attempts to bite like the Common Wombat ; it is fed artificially on bran and weeds, and drinks freely of water. The only sound it emits is a short quick grunt when annoyed ; it sleeps a good deal during the day, and appears impatient of heat and rain, as in its wild state it is entirely a burrowing animal, living in large holes in the limestone districts, and only leaving its habitation towards dusk for the purpose of obtaining food. The specimen in the Gardens is fond of lying on its back like a bear, the feet are thoroughly plantigrade, and on the inner hind toe the claw is quite rudimentary. He will burrow 3 or 4 feet into the soft ground of his enclosure, and scratches alternately with his fore paws. When worried he will turn his hind quarters to the enemy, and, suddenly turning round, make a charge at his legs, evidently for the purpose of throwing him down ; otherwise he is perfectly harmless. He runs fast for a short distance in a sort of gallop, but soon tires, and is easily caught. Although in some parts of the colony, especially on Yorke's Peninsula and about Port Lincoln, the holes of these Wombats are very numerous, yet the animals are but rarely seen. Many of the oldest colonists have informed me that they never saw a Wombat alive. The blacks on the Murray describe two kinds of Wombats ; one (evidently *P. latifrons*) they speak of as "big yellow fellow," the other as being smaller and dark ; they also say that the impressions of their feet in the sand-tracks leading to their burrows bear a striking resemblance to those of the foot-prints of a young child. The flesh

they describe as being like pork, and excellent eating. They are extremely difficult to obtain on account of their great timidity. The usual plan is to make a screen of boughs in the vicinity of their haunts, behind which the natives conceal themselves; and then, if not killed on the spot, they will scramble to their holes, from whence it is utterly impossible to dislodge them.

Collingrove, South Australia,
April 1861.

LIST OF SPECIES COMPOSING THE FAMILY MEGAPODIIDÆ;
WITH DESCRIPTIONS OF NEW SPECIES, AND SOME ACCOUNT
OF THE HABITS OF THE SPECIES. BY GEORGE ROBERT
GRAY, F.L.S., ETC.

1. TALEGALLUS CUVIERI, Less. Voy. Coq. i. p. 716.

Talegalla Cuvieri, Pr. B. Compt. Rend. 1856, t. 38. p. 876.

New Guinea (Havre Dorey); Aru Islands.

2. TALEGALLUS LATHAMI.

New Holland Vulture, Lath. Hist. of B. i. p. 32.

Alectura —, Lath. Hist. of B. x. p. 455.

Alectura Lathamii, Gray, Zool. Misc. i. p. 3.

Meleagris Lindsayi, James, Mem. Wern. Soc. vii. p. 473.

Catheturus australis, Swains. Classif. of B. ii. p. 206.

Catheturus Cuvieri (Less.), Bl.

Talegalla Lathamii, Gould, B. of Austr. v. pl. 77.

Catheturus Novæ Hollandiæ (Lath.), Pr. B. Compt. Rend. 1856,
p. 376.

Brush Turkey.

‘Wee-lah’ of the natives.

Australia.

3. MEGACEPHALON RUBRIPES, G. R. Gray & Mitch. Gen. of B.
iii. pl. 123 (adult).

Megacephalon Maleo, Temm.; Wallace, Ibis, 1860, p. 142.

Megapodius rubripes, Quoy & Gaim. Voy. Astrol. t. 25 (young).

Celebes (Menado).

4. LEIPOA OCELLATA, Gould, Proc. Z. S. 1840, p. 126; B. of
Austr. v. pl. 78.

‘Marrakko,’ ‘Marra-ko,’ of the natives of S. Australia.

‘Ngow-o,’ ‘Ngow,’ of the natives of W. Australia.

5. MEGAPODIUS FREYCINETI, Quoy & Gaim. Voy. Uranie, t. 32.

Juv. *Alethelia Urvilii*, Less. Voy. Coq. i. p. 703, t. 37; Pr. B.
Compt. Rend. 1856, p. 876.

Island of Waigiou; Guébé, Boni; Batchian? and Kaisa Islands?

6. MEGAPODIUS QUOYII.

Megapodius Freycineti, p., G. R. Gray, Proc. Z. S. 1860, p. 362.

Like the Batchian examples of the former species; but it is of a

more slaty fuscous-black, especially on the head, neck, and breast ; quills fuscous black ; tarsi apparently of a pale horn-colour.

The young differs from that of the former species in being also more of a slaty black on the head, neck, and breast, and the plumes of the wings sooty black, rather narrowly margined and banded with ochre. These marks are decidedly more prominent in this species than in the young of the last ; cheeks and throat ochraceous white ; the buff spot on the abdomen appears to be, when first hatched, buffy white.

Gilolo (South).

7. *MEGAPODIUS FORSTENI*, Temm. ; G. R. Gray & Mitch. Gen. of B. iii. pl. 124.

Megapodius Freycineti, p., Temm.

Top of the head, wings, and back olivaceous-brown, tinged with obscure rufous ; front, sides of the head, neck, breast, and nape slaty fuscous ; abdomen fuscous, slightly tinged with slate-colour. Bill pale horn-colour ; feet plumbeous black.

Length 13", wings 8" 3"', tarsi 2" 7'''.

Amboina ; Ceram ; Banda ?

8. *MEGAPODIUS MACGILLIVRAYI*.

Top and sides of the head, back, wings, tail, sides of the abdomen, and under tail-coverts deep olivaceous fuscous, tinged with obscure rufous ; neck, nape, some of the lesser wing-coverts, and beneath the body slaty black. Bill dark horn-colour ; feet pale (red) ; claws black.

Length 13" 6"', wings 9", tarsi 2" 2'''.

Louisiade Archipelago (Duchateau Isles and Pig Island).

9. *MEGAPODIUS LA PEROUSI*, Quoy & Gaim. Voy. Uranie, t. 33.

'Passegniat' of the natives.

Ladrone or Marian Islands (Tinian, Guam, and Rotta).

10. *MEGAPODIUS GILBERTII*.

Megapodius rubripes, p., Wagl. Isis, 1829, p. 737 ?

"*Megapodius of small size*," Wall. Ibis, 1860, p. 142.

Top of the head, nape, neck, and wings olivaceous brown, tinged in part with obscure rufous ; front, sides of the head, collar round the neck, and beneath the body slate-colour. Bill fuscous horn-colour ; feet plumbeous black.

Length 12" 3"', wings 8", tarsi 2" 2'''.

Celebes.

11. *MEGAPODIUS CUMINGII*, Dillw. Proc. Z. S. 1851, p. 118, pl. 39.

Philippine Islands (Manilla) ; Labuan ; Borneo (North-western) ?

12. *MEGAPODIUS GOULDII*.

Top of the head greyish-olivaceous brown ; back, wings, sides of

the abdomen, and beneath the tail rufous-olivaceous brown; sides of the head, neck, nape, and beneath the body slate-colour. Bill pale horn-colour; tarsi pale red; toes blackish, claws black.

Length 11" 6"', wings 8" 3"', tarsi 1" 11"'.
Lombock.

13. MEGAPODIUS NICOBARIENSIS, Bl. Journ. A. S. B. xv. pp. 52, 372.

Nicobar Islands.

14. MEGAPODIUS REINWARDTII, Wagl. Syst. Av. Megap. Addit. sp. 4.

Megapodius Duperreyi, Less. Bull. Univ. des Sci. no. 5. p. 113; Voy. Coq. t. 36.

Megapodius rubripes, Temm. Pl. Col. 411; Wagl. Isis, 1829, p. 737; Less. Tr. d'Orn. p. 479.

'Mangoipe' of the Papuans.

New Guinea (Havre Dorey, River Oetanata); Amboina?; Aru and Ké Islands.

15. MEGAPODIUS TUMULUS, Gould, Proc. Z. S. 1842, p. 20; B. of Austr. v. pl. 79.

'Ooregoorga' of the natives.

Australia (North); Islands in Endeavour and Torres' Straits.

16. MEGAPODIUS WALLACEI, G. R. Gray, Proc. Z. S. 1860, p. 362, pl. 171.

East Gilolo.

17. MEGAPODIUS STAIRI.

Megapodius — ? G. R. Gray, List of B. of the Trop. Isl. B.M. p. 46.

Egg dusky white. Length 3" 1"', width 1" 1"'.
Samoan or Navigator's Islands (*Rev. J. B. Stair*, 1847).

18. MEGAPODIUS BURNABYI.

Megapodius — ? G. R. Gray, List of B. of the Trop. Isl. B. M. p. 46.

Egg pinkish stone colour. Length 3" 1"', width 1" 9"'.
Hapace Islands (*Lieut. Burnaby, R.N.*).

These two latter species are only known by a specimen of the egg from each locality having been presented to the British Museum. I have here provisionally placed a specific name for each; having little doubt that they will prove distinct species from each other, and even from all the other known species.

19. ? MEGAPODIUS ? ANDERSONI.

Tetrao australis, Anders. MSS.

"*Fusco nigroque; pedibus nudis.*"

New Caledonia.

The name given above (with the very short specific characters) was found among others in the manuscripts of Anderson, who was assistant-surgeon during the third voyage of the famous circumnavigator Cook. Though the description is so short and concise, I am, however, induced to suppose that it can only be referred to a species of *Megapodius*; certainly it cannot be reconciled with any of the present known birds from New Caledonia. I refer to it in the hope that this slight indication may lead to its being searched for by collectors and others who may be located in that island, thus proving whether I am right in my supposition with regard to its being one of this remarkable genus.

The family of *Megapodiidæ* is composed of a series of birds which are very remarkable for the extraordinary and anomalous contrivances resorted to by the different species for obtaining the artificial heat that is necessary for bringing their eggs to maturity; and for other singularities in their general habits, &c. The account which follows is principally collected together into one view from different published sources.

These birds are all, with one solitary exception, as far as is at present known, inhabitants of certain localities within the tropics, viz.:—

Nicobar Islands, Lombock, Borneo (N.W.), Labuan, and Luçon. Celebes, Gilolo, Batchian, Ceram, Amboina, Banda Islands, Guébé, Boni, and Waigiou Islands.

New Guinea, Louisiade Archipelago, Aru and Ké Islands.

Australia (North, West, and South), Islands in Endeavour and Torres' Straits.

Ladrone or Marian Islands. They are also known to exist in Hapae or Habai Islands, Samoan or Navigator's Islands; and probably in New Caledonia.

They generally inhabit the dense forests, brushes, and mangrove swamps, or jungles of luxuriant vegetation, especially those that border the sea-beach, or rivers and creeks; but others (*Leipoa ocellata*) prefer the sandy districts of the scrub.

Their appearance when walking in open places is stately and somewhat sedate; which may be occasioned by their habit of lifting their feet very high, and of setting their backs up, somewhat like the guinea-fowls. Their extreme shyness and timidity causes them to reside in, or to remain in close approximation to, the thickets, &c., that they may escape, if disturbed, by running (which they do with great quickness) among the vegetation; but should they fail thus to conceal themselves, they then fly on to the lower branches of the trees, where they remain quite motionless, with the neck sometimes stretched out in a line with the body, or they ascend to the top of the tree by leaping from branch to branch; and should they still be alarmed they will fly off with a heavy flight for a short distance to some other more secure position, where they can only be approached by carefully proceeding under cover of the large trees. It has, however, been remarked that some species have never been seen to perch.

They are often heard uttering at intervals a loud clucking or

screeching noise, while they lie concealed beneath the shady branches of the trees during the midday heat. Some have been observed to dust themselves on the sandy ground after the manner of gallinaceous birds; and they have been noticed to be apparently very pugnacious at times, swiftly chasing each other along the ground, and calling to one another more loudly than usual, suddenly stopping, and then again running off in pursuit.

Their food is entirely sought for on the ground; it is obtained by scratching among and turning up the fallen débris beneath the trees and shrubs in the forests, &c., and consists of seeds, fallen fruits, insects, and small snails: but one species is thought to feed chiefly on fallen fruits resembling the cotyledons of leguminous seeds; and rice is also said to form a portion of its food.

The species that form mounds for the purpose of incubation, usually select during the tropical spring a retired and shady place in the dense thickets or brush, occasionally surrounding the trunk of a tree by a portion of the materials employed in its formation, should it come within the prescribed limit of the mound.

The mound is composed more or less of vegetable matter, which becomes decayed and rotten during the period that the birds are engaged in laying their eggs, which is thought to be an occupation of two or three months' duration. The size of the mounds varies with the species; some have been found reaching to 14 feet in height (24 feet from the base of the slope to the summit) and 150 feet in circumference, and some are even larger. The materials required in their construction are collected by the birds by means of their large feet, either by carrying a small quantity at a time in one foot, or by scratching it together with their lengthened claws, and thus leaving the earth bare for some distance round the mound. The mound of some species (*Talegallus*) is entirely composed of vegetable matter; others (*Leipoa ocellata*, *Megapodius Macgillivrayi*, *Megapodius tumulus*), however, mix with the vegetable matter earth, sand, gravel, stones, and even, in some cases, fragments of corals; in fact, the birds employ whatever falls in their way at the locality they have selected. The same pair frequent the mound year after year, destroying that of the former year on the renewal of the season for laying; thus the vegetable portion of the centre becomes mixed with the sand and earth that formed the outer part of the former mound. The pair, on renewing the mound, first collect a new mass of vegetable débris for the centre, on which is scratched some of the former material to a certain height, leaving the centre somewhat hollow. It is in the middle, at various depths, from 18 inches to several feet, according to the habits of the different species, that the females of some species deposit their eggs, in the form of a circle (*Talegallus*, *Leipoa*), while others place them in an irregular manner in separate excavations in different parts of the mound. The eggs are deposited at about sunrise, one by one, at an interval of days between each, reopening the centre on each egg being placed therein, and then covering it again, and returning each time to their usual haunts in the thickets, &c., until all the eggs intended to be laid are

deposited. The centre is then completely covered in, and the mound becomes elevated to the height of several feet with the remaining earth or vegetable matter, assuming a conical or dome-shaped form ; but the large mound has the top flattened for about 3 feet in diameter. The heat that is engendered by the fermentation of the vegetable matter is thus retained within the mass, and causes the eggs to arrive at the period of maturity.

It is thought that the bird allows the centre to be but slightly covered during the period of laying—for two reasons : first, that it may have the less to scratch away on each visit, and thus be enabled more easily to deposit the egg ; secondly, that the eggs already laid may be kept in a cool and certain temperature until all are deposited ; while, at the same time, the rain may more readily penetrate through to the vegetable mass, which would hasten the rotting, and thereby raise the necessary heat for the hatching against it is really required.

The mode adopted by the Megapode of Banda (*Megapodius amboinensis*?) differs materially from that of the species above referred to. It is stated that the eggs of this bird “occur isolated and dispersed here and there ; but each egg was carefully covered by a mass of fragments of dry plants or leaves.”

Another remarkable difference is exhibited in the habits of the small Celebian Megapode (*Megapodius Gilbertii*). This species is observed “to scratch out a hole in the rotten stump or root of a fallen tree, and there bury its eggs ;” but nothing is said about covering them with vegetable débris or other matters, which we may, however, suppose them to do, as is exemplified by the other species of this singular family.

There are other species whose habits are still more extraordinary in the selection of places for the incubation of their eggs.

One species (*Megacephalon*), which resides many miles away in the inland forests, and others (*Megapodius Freycineti*, *M. Cumingii*, *M. nicobariensis*) that live in the jungles not far removed from the beach, seek daily in pairs (often thus congregating in flocks of hundreds at the period of laying their eggs) the sea-beaches, where, in a retired position in the masses of sand thrown up above high-water mark, as well as near the neighbouring jungles, may be observed a number of holes of various diameter scratched in the sand : so rapidly do the birds throw up the sand, that it looks completely like a fountain during the operation. The holes are usually of the depth of 18 inches to 2 feet ; in them, it is thought that “a number of hens” deposit in succession their eggs, upright in the sand on the side of the same hole at a distance of a few inches between each. The number of eggs has been found to vary in the different holes, which may, in some measure, depend on the number of females that visit each. Each egg of the same female must, however, be, as in the former case, laid at an interval of some days ; but whether they return to, and lay their eggs in, a hole already formed by a single pair or by several pairs in company on the same day, is not quite determined. Each separate female must, after the hole is made, when about to lay, scratch a place for the egg on the side within the hole,

and when deposited must cover it with some portion of the sand which is around it, and thus by degrees the interior of the hole becomes mostly filled in, after which the place of concealment is often betrayed by the birds scratching over it a large heap of such shells and rubbish as they may meet with on the beach. The eggs are then left to be hatched by the heat engendered in the sand through the rays of the tropical sun playing on its surface; probably a longer period for hatching the eggs is required than from the heat caused by the fermentation of decaying vegetable matter, the heat of which is known to be considerable.

Thus, if the preceding statement is correct, the eggs in one hole have been laid and the hatching of them has commenced about the same time; and therefore it may be concluded that, after the necessary time has elapsed, all the young birds are likely to make their appearance about the same period.

It has been previously stated in reference to some of the mound-raising species (*Talegallus*, *Leipoa*) that the eggs are placed by the bird in a circle. The mode thus adopted by the bird is interestingly accounted for by His Excellency Sir George Grey, in the following manner:—After the bird, he says, has deposited the first egg in the sand, leaving from 4 to 6 inches between the lower end of the egg and the layer of dead leaves, it then lays the second egg, which is “deposited in precisely the same plane as the first, but at the opposite side of the hole before alluded to. When the third egg is laid it is placed in the same plane as the others, but, as it were, at the third corner of a square. When the fourth egg is laid it is still placed in the same plane, but in the fourth corner of the square, or rather of the lozenge, the figure being in this form $\sphericalangle$. The next four eggs in succession are each placed in the interstices, but always in the same plane; so that at last there is a circle of eight eggs all standing upright in the sand with several inches of sand intervening between each.”

Other species do not regard such mathematical principles in the laying of their eggs, but place them irregularly anywhere within the mound, or in whatever position the several species may instinctively adopt, as previously explained. That they may obtain the heat required to bring them to maturity appears to be the principal object.

It seems marvellous that these birds, after they have taken all these precautions for the preservation and development of their eggs, should exhibit no further care for them, but leave the young entirely to find for themselves their way out of whatever position the females may have placed the eggs in. The young bird, on breaking the shell, scratches its way out of the heap without any assistance, and when free, just shakes off the material of which the heap had been composed, and then runs off to the thickets, &c., and commences seeking its food without any hesitation, by scratching and turning up the earth or débris that lie on it, like an old bird. Each bird is fully fledged on its first appearance. This latter circumstance has caused some collectors and ornithologists to suppose these young birds to be the adult state of a species; and the idea has occasioned

the establishment of the generic appellation of *ALECTHELIA*, with the specific name of *Urvilii*, Less. This name has been attached to all the specimens of young birds sent from various localities, though in colour and markings they differ from each other, but retain somewhat of the colour of the parents. Thus, *M. Freycineti* and *M. Quoyi* are of a sooty-black colour, with the cheeks and throat of a pale ochraceous colour; but the markings differ in each species: the former has the wing-coverts margined, and all the quills banded, with pale ochre-colour; in the latter, however, it is only irregularly banded on the tertials and lower part of the back. On the other hand, the young of *M. Reinwardtii* and *M. tumulus* are of a rufous colour; the former has the back of the neck and nape greyish-brown, throat ochraceous white, breast and beneath the body greyish ochraceous with a buff spot on the abdomen, quills fuscous, wing-coverts and tertials margined with deep rufous, feet pale. The latter species is very similar, but appears to be more decidedly margined on the wing-coverts and tertials with pale rufous, conveying the appearance of bands; throat rufous ochre; and beneath the body of a somewhat darker colour than in the previous example. These differences between the young and adult birds are so strongly marked, that even Mr. Wallace states, with regard to one sent home by him, that "he is convinced it is an adult bird," "as it is considered to be by the natives of Aru."

The egg is remarkably large when on the point of being laid (measuring from $3\frac{1}{2}$ to $4\frac{1}{4}$ inches in length, and 2 to $2\frac{1}{2}$ inches in width, weighing 8 or 9 ounces); it consequently fills up, says Mr. Wallace, the lower cavity of the body, squeezing the intestines so that it seemed impossible for anything to pass through them; while the ovary contained from eight or ten eggs about the size of small peas, which must evidently require somewhere about the time named (thirteen days the natives assert) for their successive development. A considerable interval, says Mr. Wallace, "must elapse before the succeeding one can be matured. The number of eggs which a bird produces each season seems to be about eight;" so that, if this supposition is correct, "an interval of three months must pass between the laying of the first and last egg."

The eggs vary from white to cream- or pale salmon-colour. Some eggs are often covered with an epidermis of a dirty-brown colour, which easily chips off, exposing the proper colour of the egg.

The birds place the egg upright in their mounds or other places, so that the egg may obtain the heat equally on all sides,—as other birds, which sit on their eggs, continually turn them so that each side may equally obtain the same amount of heat from their bodies, which is essentially requisite, or the egg would not be brought to perfect maturity.

The eggs, it is said, "when quite fresh are delicious eating, as delicate as a fowl's egg, but much richer." The natives of the Hapace Islands, either from their rarity or from their great delicacy, look upon the eggs found in their islands as worthy to be reserved for the chief's eating; and for that reason they are denominated "Chief's

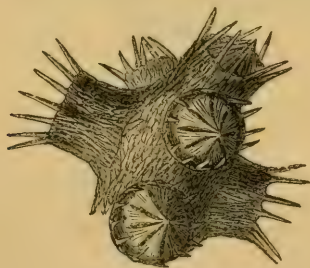
Eggs." The flesh of the adult bird of some species has been pronounced to be good eating.

DESCRIPTION OF A SECOND SPECIES OF ACANTHOGORGIA (J. E. GRAY) FROM MADEIRA. BY JAMES YATE JOHNSON.

In the 'Proceedings of the Zoological Society' for 1857, p. 128, was printed a description of a new genus of *Gorgoniadæ* by Dr. J. E. Gray, founded on a specimen in the British Museum, the habitat of which was unknown. The genus was named by its describer *Acanthogorgia*, and the specimen was figured, by an inadvertence, in the 'Proceedings of the Zoological Society' for 1851 (*Radiata*, Pl. III. fig. 2), under the name of *Nidalia occidentalis*, instead of *Acanthogorgia hirsuta*, Gray. I am now in a position to state that the native place of this curious Black Coral (of which no notice has been taken by M. Milne-Edwards in his work on Coralliaria) is Madeira; for I possess one specimen, and have seen others, obtained from deep water near that island. Last winter a specimen of Black Coral fell into my hands (also obtained from the same coast), which, though evidently belonging to the genus *Acanthogorgia*, appeared on examination to be specifically distinct from the species previously described. I now proceed to lay before the Society a description of this second species, which I have named, in honour of the founder of the genus to which it belongs,

ACANTHOGORGIA GRAYI.

Colour dark brown. Branching irregularly, with a tendency to grow in one plane. Branches free, slender, flexible, having an average diameter of one-seventh of an inch; the thickest part of the stem near the base has a diameter of three-tenths of an inch; the ends of the branches are rounded, and thicker by one-half than the neighbouring portion of the branch. Axis pale brown, very slender, that of the smaller branches, when dry, being not more than the twentieth



Acanthogorgia Grayi.

of an inch in diameter. When the coral has been a few days out of the water, the axis shrinks from the bark, and remains distinct in the

middle. It is composed of fibrous matter without spicula. Caustic alkali has little or no effect upon it, even on the application of heat. Bark composed almost entirely of spicula, studded with sessile cylindrical cells, irregularly distributed on all sides. These cells have a height of from the thirtieth to the twentieth of an inch, and their diameter is about half the height. The upper halves of eight (sometimes nine) large erect spicula project round the orifice of each cell at eight angles, corresponding with the same number of slightly elevated ribs or crests on the outside of the cell formed by other spicula; the exposed portion of these projecting oral spicula is smooth. In *A. hirsuta* the exposed portions of the corresponding spicula are rough. The orifice itself in a dry specimen is covered in by another series of large spicula, sixteen in number, arranged in eight pairs, the apices of which meet in the middle. At the outside of the cells the spicula are placed parallel, not crossed as in *A. hirsuta*.

The spicula are composed of calcareous matter, and are at once dissolved with effervescence on the application of a strong acid, leaving behind a formless mass of brown animal matter. The spicula which lie in the bark between the cells are fusiform, slightly bent, and for the most part very stout, some elongated, others contracted to an ovoid form; those which project round the orifices of the cells have their basal portion geniculate, flattened, and very rough, with protuberances; and not unfrequently the bases are branched. The spicula of both species are pretty objects under an object-glass of low power.

Acanthogorgia Grayi differs from *A. hirsuta* (of which a figure is here given for comparison) in the much smaller size and in the form of



Acanthogorgia hirsuta.

the cells, which are cylindrical, not bell-shaped or contracted at the bottom. In the only specimen of the former which I have seen, the cells are not nearly so numerous as in the specimens of the latter which have come under my notice. Moreover, the orifices of the cells in *A. hirsuta* are not roofed in with spicula in the same complete and regular way as is the case with the cell-orifices of this species. Lastly, I have not noticed any branching at the bases of the large spicula of *A. hirsuta*.

The only specimen of this very curious Black Coral which has

fallen in my way, and which I have had the honour of presenting to the British Museum, was brought to me when residing at Funchal in the month of February last. It was said to have become entangled in a fishing line, and to have been brought up from a considerable depth near Ponta do Pargo, the south-west extremity of the island. It was attached to a stone on which a small specimen of *Dendrophyllea ramea*, a not uncommon Madeiran coral, was seated. It has a height of 6 or 7 inches, and it measures about 10 inches across.

MISCELLANEOUS.

Investigations of the living Brachiopoda of the Mediterranean.

First Memoir: on *Thecidium*. By M. LACAZE DUTHIERS.

THE *Thecidia*, fixed by the convex face of the concave valve, only move the dorsal or apophysary valve. Four muscles serve to lower the latter and close the shell. There are two to open it; they form the innermost pair. The separation of the valves is active, and the abductor muscles act as the power of a lever of the first order.

The arms would resemble in many respects those of other Brachiopoda, if they were not adherent to the mantle all along their basal ridge. D'Orbigny's expression of *abrachiopodes*, applied to the *Thecidia* is entirely false: indeed, what is a Brachiopod without arms?

The cirri present two very distinct structures:—a cortical layer, which is soft and easily destructible—the cellular envelope; and a hard, resistant, and nearly cartilaginous axis, which is the framework. They differ a little in the two sexes; these differences will come into consideration in connexion with the reproduction.

The mouth occupies precisely the same situation as in the other Brachiopods. In all, in fact, the arms are united by the arc of a circle—a true, more or less concave horseshoe, which they form by becoming confounded on the median line; and it is at the bottom of this curve at the middle that we see the buccal orifice, always in front of the ridge, the base of the arms, and the insertion of the cirri. The stomach is surrounded by the two packets of cæca which constitute the liver. The intestine presents a very curious peculiarity, already indicated by MM. Hancock and Huxley in the *Terebratulæ*. It terminates in a delicate ligament, and presents no anus. Examination by the lens, and even under high powers of the microscope, left no doubt upon this point.

Behind the mouth, above the arc formed by the base of the arms, there is a nervous centre composed of ganglia, from which issue numerous nerves passing to the two lobes of the mantle and other parts of the body.

The sexes are separate. The testes and the ovaries only exist in one lobe of the mantle—that corresponding to the deeper or inferior valve. The two testes, like the two ovaries, are hidden beneath supplementary osseous plates developed in the thickness of the mantle. The spermatozoid is very small, with a very delicate tail and a

globular head. The ovaries resemble little bunches of grapes of an orange-colour, but each grain is formed by an egg, and not by a secretory cæcum.

The egg during its development projects out of the gland, and is suspended by a peduncle, which is very probably broken at the period of extrusion.

On each side of the median line in the concave valve there is a glandular canal, with an internal and external orifice; this, which represents what Mr. Hancock calls the supposed auricles of the pseudo-hearts, is in relation to the ovary or testis, and serves, probably, for the issue of the ova and seminal fluid.

The young embryos of the *Thecidia* are suspended from two of the cirri of the arms—those of the middle behind the mouth. These cirri, which may be called suspensors, curve backwards and bury themselves in a median incubatory pouch, placed between the two ovaries. This peculiarity impresses upon the shell a character which enables us to distinguish the male from the female *Thecidia*, when the animal no longer exists. A small notch for the passage of the two embryoniferous cirri upon the external twisted lamella which supports the arms always indicates the female sex. There are few examples of this possibility of recognizing the sexes of shells.

The entire series of the development of the ova could not be investigated. The youngest embryos observed resembled an aggregation of large cells. Starting from this state, in which the young animal is ovoid, three furrows are seen to be formed perpendicular to the principal axis, dividing the embryo into four lobes; the two median are comparatively very large, the two outer ones very small. One of the latter appears to be hollowed into a cavity like a sucker; the other presents a longitudinal fissure surrounded by two or four red eye-like spots. It is very probable that this is the anterior extremity, and that its fissure becomes the mouth. The embryos move by the agency of the vibratile cilia with which they are covered; they often contract themselves. They appear to bend themselves upon the median furrow, and then the greater diameter is much diminished. The substance contained in the anterior median lobe breaks up into lobules, which will afterwards represent the cæca of the liver.—*Comptes Rendus*, November 11, 1861, p. 849.

On a new Species of Neotoma (N. ferruginea) from Guatemala.

By R. F. TOMES.

The present species of *Neotoma* is so well-marked a species that it will be scarcely necessary to lengthen the description by comparing it with other species of the genus.

It is typically a *Neotoma*, and in size about equals the *Mus rattus* of Europe. General form rat-like; the head rather elongate, and the muzzle somewhat pointed. Muffle small, being little more than a flat space between the nostrils, and with scarcely any part quite free from short, fine, scattered hairs. Upper lip cleft from the muffle downwards, and well covered with short hairs; nostrils rather small

and rounded. Ears simple, roundish, of medium size, and not concealed by the fur. Whiskers quite as long as the head. Fore feet short; the two middle toes of equal length, the outer one about $1\frac{1}{2}$ line shorter, and the inner one not more than 1 line shorter; claws very short, thumb rudimentary, its nail rounded. Palms with five well-defined and rather large tubercles, of which the anterior one occupies a position at the root of the middle toe, two others are placed one at the root of each of the outer toes, and the remaining two have a transverse position behind those just mentioned, nearly as far back as the carpus, the outer one being a little the further back of the two. The hind feet are remarkable for their breadth, and for having, like the fore feet, toes which are nearly of a length. The tibia is rather long in relation to the foot, although perhaps not in relation to the size of the animal. On the sole of the hind foot are six tubercles, the three anterior ones arranged like those of the fore feet, and a fourth appears at the root of the inner toe. Immediately behind the tubercle of the outer toe, and near to the middle of the sole, is placed the fifth, which is much smaller than the others, and behind that of the inner toe is the sixth, much the furthest back, and near the inner boundary of the sole. The arrangement of these tubercles is much the same as in *N. floridana*; but in consequence of the shortness of the foot, they are of a less elongated form, though fully as prominent. The claws, like those of the fore feet, are short. The tail is as long as the head and body, and tapers evenly to a somewhat obtuse point; it is finely annulated, and pretty evenly suffused with short black hairs, which do not conceal the scales even towards the end of the tail, where they are most abundant. The under surface is much less distinctly hairy than the upper.

The distribution of hair on the under surfaces of the fore and hind feet is as follows:—Short and thick fur, of nearly the same quality as that of the body, extends on the fore legs quite to the carpus; it is white inside the leg, and of the same colour as the upper parts of the body outside of it. On the upper surface of the toes the hairs are silvery white, adpressed, short, and projecting forward around the claws so as to hide them. The hind legs have the tibiae densely hairy behind, quite to the *os calcis*, and from thence there is an extension of adpressed greyish hairs along the inner side of the sole to the posterior tubercle; but there is a very narrow line left near the outer boundary of the sole, which is quite free from hairs. On the upper surface of the foot the hair of the legs extends somewhat further, and from this the foot is covered with short, adpressed, silvery hairs, grey on the foot and white on the toes.

The general colouring is remarkable, and unlike that of any other species of *Neotoma*. All the upper parts are of a bright rufous colour, and all the under parts pure white, the line of separation being very clear and distinct. The fur of the back is mixed with black hairs, giving that part a much darker colour than the sides of the body, where these hairs are less abundant. Fur of the outer surface of the fore and hind legs strongly tinged with dusky, inner surface of the fore legs whitish, of the hinder ones dusky grey. On

nearly all parts of the body the fur is bicoloured, dusky at its roots for two-thirds of its length; on the upper parts the dusky colour becomes almost black, and on the under much paler. From the chin to the space between the fore legs is an elongated patch of fur which is pure white from root to tip, just as in *Hesperomys atrogularis*. The tail is deep dusky above, paler below; claws white.

In the outline of the grinding-surfaces of the molar teeth, this species differs from all others at present described. Without entering into a minute description of these teeth, of which it is difficult to give a clear idea without figures, it may be stated that they have somewhat the same arrangement of cusps as those of *N. cinerea* of Baird, saving that in the present species the anterior cusp or prism of the first tooth in the lower jaw is in a position decidedly outside the line of the cusps of the other teeth. The exposed ends of what I have termed the prisms of these teeth constitute their grinding-surface, which, instead of having an angular outline as in *N. cinerea*, present, as in those of *N. floridana*, a series of transverse, ovoid or loop-like figures; but these loops in the present species are much narrower in an antero-posterior direction than in any other species, owing to the folds of enamel entering more deeply and broadly into the sides of the tooth.

Length of the head and body	6	6
—— of the head	1	9
—— of the ears	0	8
—— of the fore-arm	1	3
—— of the fore foot and claws	0	8
—— of the tibia	1	5
—— of the tarsus and toes	1	3
—— of tail	6	0
Breadth of the ears	0	8
—— of the hind feet at the root of the inner toe	0	3
Length of the skull from the front of the nasal bone to the occipital crest	1	8
Breadth across the zygomatic arch	0	11
Length of the nasal bones	0	8
—— from the point of the upper incisor to the crown of the first molar	0	6
—— of the molar series	0	4
Length of the incisive foramina	0	4
—— of the palate	0	4
Breadth of palate between two front molars ..	0	1½
—— of palate between two posterior molars ..	0	2
Length of lower jaw from point of incisors to condyle	1	0
Depth from coronoid process to the angle	0	6

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XII.—*Anatomico-physiological Investigations on the Respiratory Process in Insects.* By H. RATHKE*.

I. PERFECT INSECTS.

§ 1. ROESAL, in the second volume of his 'Insekten-Belustigungen,' has noticed that in *Æschna grandis* the abdomen is alternately expanded and contracted, and that this movement is connected with the respiratory process. Carus subsequently made the same observation on *Locusta verrucivora*. These assertions led Rathke, in 1831, to examine all the larger insects which he could procure in the vicinity of Dorpat, to see whether they exhibited these movements of the abdomen. He found that, in the majority of insects which he could obtain for examination, the abdomen is alternately expanded and contracted; and fully convinced himself that in *Cetonia* and *Scarabæus* this movement has an effect upon the respiration.

§ 2. In all insects in which such movements of the abdomen may be distinctly perceived; these are not of the same kind, but in different insects they present many differences. These differences depend upon the peculiar organization of the wall of the abdomen. But whatever may be the kind of movement, it is always caused and rendered possible,—1, by the epidermis of the abdomen being solid and thick in some parts and soft and thin in others, so that those parts of the cutis on which the epidermis forms plates or bands of greater or less thickness may be pushed closer together and then again somewhat removed from each other; and 2, by the presence of peculiar muscles on the inner surface of the cutis of the abdomen, passing from one part of the cutis to the other, and capable of effecting a movement in it.

* This posthumous memoir, prepared by Rathke in 1835, has just been published by Dr. Hagen in the 'Schriften der Königl. physik. ökonom. Gesellschaft zu Königsberg,' 1st year (1861), p. 99. Translated by W. S. Dallas, F.L.S.

In general the cutis of the abdomen has several transverse bands, upon each of which the epidermis is harder and thicker than in the space between it and the next band; and it is only exceptionally that in some insects the spaces between the bands are either only represented by a constriction or completely unrecognizable. But when a thinner and softer skin is interposed between two bands, the posterior and smaller one is generally more or less immersed in the preceding, so that its anterior margin is more or less concealed by the posterior margin of the latter. Each band usually consists of two distinct halves, an upper and a lower one, united at the sides of the body, like the bands themselves, by a thinner and softer part of the cutis. In many insects, especially the Hymenoptera, the upper half or plate of most of the bands embraces the lower one more or less; but this is not the case in the majority, in which the softer part between the upper and lower halves may be recognized from without; this becomes broader and more distinct in proportion as the sexual organs are dilated by their products, or the intestinal canal is filled with food.

The muscles by which the hardened parts of the abdominal skin are united and moved are so arranged, in most insects, as only to approximate these parts; by which they only diminish the cavity of the abdomen, and produce an expiration. Hence, in the following memoir, whenever the abdominal muscles are spoken of without any special qualification, those which relate only to expiration are intended. The means by which the hardened parts of the skin are again separated, and the cavity of the abdomen again dilated, to produce inspiration, will be referred to hereafter.

§ 3. In most Coleoptera it is the superior wall of the abdomen that moves in respiration, being alternately depressed and elevated. This movement, however, does not extend in all over a relatively equal portion of the abdomen. In those whose elytra extend over the whole abdomen, all the belts or segments of this division of the body, with the exception of the last, usually take part in the movement; whilst in those, such as *Scarabæus* and *Cetonia*, whose elytra do not reach so far, the penultimate and even the antepenultimate segments take no part in it, which is indeed the case with all those segments which are of nearly equal thickness throughout and form a simple ring. Movement is observed in all those segments in which the epidermis of the ventral and lateral walls presents a firm plate, but in which that of the dorsal wall forms a thinner and usually smaller plate, separated by a membranous interspace at its ends from the above-mentioned larger plate, and at its anterior and posterior margins from the similar neighbouring plates. The movement is gene-

rally progressive, advancing rapidly from before backwards, rarely commencing in the middle of the abdomen and spreading both forwards and backwards.

The muscles by which these movements are produced are exceedingly simple. Each segment which takes part in it is furnished only with a single pair of muscles for this purpose, each of which is attached by one end to the lateral wall and by the other to the dorsal wall or plate, in both places close to the soft part of the cutis. All these muscles, therefore, run transversely across the softer and more flexible parts of the abdomen. When they contract, the dorsal wall of the segment to which they belong is drawn downwards more or less according to the extent of the soft interspace, by which the cavity of the abdomen is more or less diminished and the softer skin of the interspace more or less folded. The respiratory movements are stronger in some Beetles, weaker in others. In those which need strong respiratory movements the above-mentioned muscles are more coarsely fibrous, thicker, and generally larger in proportion to the size of the entire body than in those in which weaker movements are sufficient; but in all cases they form only short bundles, which are either of nearly equal thickness and breadth throughout or become narrower and thinner from above downwards. Besides the muscles just described, several other muscular layers occur in the abdomen, both on the dorsal and ventral walls. Between each pair of the upper plates which are moveable upon one another there is, on each side, a broader or narrower muscular layer, passing from the anterior margin of the posterior plate to the inner surface of the anterior one, and adhering at a greater or less distance from the anterior margin of the latter. Similar muscular bands, situated and attached in the same way, occur also on all the inferior plates which are mutually moveable. These lower bands are usually far thicker and more coarsely fibrous than the upper ones. Usually these two kinds of muscles only serve to bend the abdomen downwards and straighten it again; but, if they both act together, they may also shorten the abdomen a little, and if, as is usually the case, the upper wall is likewise drawn towards the lower one, diminish its cavity, and thus increase the quantity of air expelled. It must, however, be observed that such a universal contraction of the abdomen occurs but seldom, and not always even when the beetle is much alarmed.

The movement of the dorsal wall is not comparatively equal in all Beetles. The movement is greatest in those whose tracheæ possess many vesicular dilatations, such as *Cetonia* and *Scarabæus*, and less in those whose tracheæ run uninterruptedly without dilatations so as to produce a shrub-like appearance; it is least in those in which the tracheæ appear to be narrowest in

proportion to the whole body. The dilatations and contractions of the abdomen do not follow each other with equal rapidity in different Beetles; they appear generally to be rapid in proportion to the size of the air-vessels; in the Beetles examined by the author, they succeed each other most rapidly in *Cetonia* and *Scarabæus*. But here we have to consider whether the animal is quite quiet or in motion or troubled, and also whether it has lately taken a sufficiency of food or whether it is hungry; for when it has fed well or moves, the movements of the abdomen follow one another far more rapidly than when it is quiet or fasting.

Note I.—The above observations were made on species of the genera *Cetonia*, *Scarabæus*, *Cerambyx*, *Hister*, *Dytiscus*, *Carabus*, *Chrysomela*, *Tenebrio*, *Bruchus* and *Attelabus*. It is remarkable that in *Staphylinus*, in which, notwithstanding its differing so much in many respects from other Beetles, the structure of the abdominal segments and of their muscles is the same, no distinct movement of the upper pieces of the abdominal segments could be perceived. On the other hand, the upper part of the third thoracic segment was seen to rise and fall alternately, and often very considerably. The author could not ascertain whether for this movement there are peculiar muscles not occurring in other Beetles. He observed, however, that in *Staphylinus* the widest and most important air-vessels occur in the posterior half of the thorax. The above-described movements of the abdomen were not observed in *Coccinella*, in which, contrary to the general rule, the upper plates of the abdomen are larger than the lower ones. In the *Carabidæ* also (at least, in *C. granulatus*) the upper half of the last thoracic segment is moveable, and rises and falls a little during respiration, although less than the upper halves of the abdominal segments.

Note II.—In *Tenebrio molitor* the upper pieces of the abdominal segments are so transparent, that the intestines, and especially a quantity of tracheæ which run quite close beneath those pieces, may be distinctly seen through them. Many of these tracheæ, especially those which run from below upwards, may be seen in constant movement; they are observed sometimes to be alternately stretched out and again curved, and sometimes to be moved forwards and backwards. This movement is not proper to them, but is communicated by the dorsal vessel to which they are attached.

Note III.—In the vivisection of a *Scarabæus stercorarius*, the author, having removed the dorsal wall of the abdomen and drawn forth the intestinal canal a little, by which many small tracheæ were torn, was astonished to see several of these tracheæ move very briskly, like worms, in the water in which the Beetle was being dissected. For some minutes he supposed that the move-

ment was proper to the air-vessels themselves, but at last he perceived that several extremely delicate thread-worms issued from these vessels; others twisted about in some of the air-sacs of the abdomen.

§ 4. In the *Tabanidæ*, the different genera and species of which have a more or less depressed abdomen, the upper plate of the abdominal segment is somewhat larger than the lower one, and consequently assists more or less in the formation of the lateral walls of the abdomen, with which the lower plates have little or nothing to do. The thinner and softer portion of the skin intervening between the upper and lower plates is always of considerable breadth; it is always far broader at its anterior than at its posterior end, and possesses great extensibility and elasticity.

From the author's investigations of several species, and especially of *Tabanus autumnalis*, the respiratory movements of these animals are effected by the movement of the lower abdominal plates (especially those of the anterior segments) to and from the upper ones, during which the softer lateral portions appear alternately broader and narrower. But when the respiration is increased in force, the ends of the upper plates of the anterior segments, which assist in forming the lateral walls of these segments, are somewhat drawn inwards and then again pushed out. With a still more powerful respiration the lower plates are pushed a little over each other, and all drawn a very little towards the breast; so that the lower surface of the abdomen is somewhat shortened, but immediately returns to its former position.

In the *Tabanidæ*, as in the Beetles, peculiar muscles exist only for the contraction of the abdominal cavity, and these muscles coincide almost exactly in position and attachment with those of the Beetles. All these muscles are, however, both absolutely and relatively, very delicate and thin.

At the base of the abdomen there are two large air-sacs; the tracheæ are only of moderate width, and shrub-like in form. The canal which unites the tracheal stems on each side is also only of moderate size.

§ 5. In *Empis* the inferior pieces of the abdominal segments are comparatively smaller than in *Tabanus*; they form the entire ventral wall of the abdomen. Only the three or four anterior ones rise and sink alternately, but very weakly and scarcely perceptibly. The abdomen also frequently curves a little downwards.

In the *Tipulariæ* also the lower pieces of the three or four anterior segments, which are comparatively still narrower, move up and down scarcely perceptibly and but seldom. No movement that could be regarded as connected with respiration was de-

tected in the other abdominal segments of even the largest of these insects.

§ 6. The abdominal segments of the *Muscidæ* also possess two plates of hardened epidermis. In some of these animals, especially in the genus *Musca* itself, the upper plate assists to form a great part even of the ventral wall; in others it has but little to do with this. The lower plates are very considerably smaller, and in most of these insects resemble flat tiles. In some each lower plate is more elongated, and is then sometimes extremely narrow. But the most anterior of these plates is always the largest, and the rest generally diminish in size by degrees towards the posterior extremity. The interspace of soft skin on each side, between the upper and lower plates of each segment, is narrower or broader, according as the upper plate occupies more or less of the segment. It is usually very narrow, but becomes considerably enlarged when the alimentary canal is very full, or when the sexual organs, especially the ovaries, have attained a great size.

During quiet respiration only the lower pieces of the segments move a little up and down. When respiration takes place more violently, as, for instance, when a fly is held by the wings, the ends, or rather those parts of the upper plate which assist in forming the ventral wall, are alternately drawn in and pushed out, but at the same time the ventral wall, as it rises, becomes elongated, and afterwards, when it sinks, is again shortened; so that in the former case the abdomen is more straightly extended, and in the latter more curved downwards. When the fly is not troubled, the above-mentioned contraction and dilatation of the abdominal cavity takes place very rarely.

The tracheæ have a shrub-like form, and, like the canal which unites their stems on each side, are only of moderate diameter. In each side of the body, close to the thorax, there is a tolerably large air-sac.

§ 7. In *Panorpa* the upper and lower plates of each abdominal segment are of nearly equal size, and the interval on each side between the plates is proportionally very broad. Nevertheless the cutis, and especially the epidermis forming this interspace, are tolerably thick. Respiratory movements are very distinctly perceived in the three or four first segments of the abdomen: they consist in the alternate drawing in and pushing out of the skin between the plates, during which, however, the anterior half of the abdomen is scarcely perceptibly contracted from above and below.

§ 8. In the *Lepidoptera* the upper plates of the abdominal segments are not much larger than the lower ones. The intervening skin is tolerably wide, as in *Panorpa*, but somewhat

thinner and softer. The respiratory movements are of the same kind as in *Panorpa* but stronger, and extend throughout the whole length of the abdomen; in some species they are more distinctly visible in the anterior, in others in the posterior part of the abdomen.

§ 9. In *Blatta* the abdomen is broad and flat in proportion to its length. The upper halves of the segments are of the same size as the lower ones, and both extend to the rather acute lateral margins of the abdomen. Between them there is on each side a moderately wide space occupied by a soft skin, in which a series of constantly open stigmata is visible.

During respiration there is an alternate mutual approximation and removal of the upper and lower plates; but the respiratory movements do not take place rapidly.

§ 10. In the Dragon-flies it was observed that, when they are in perfect repose, that part of the abdomen on which the central nervous cord rests alternately rises and falls, although but slightly. This movement is most remarkable in the genera *Æschna* and *Libellula*, and weakest in *Agrion*; in the *Æschna* it is strongest in the posterior broader half of the abdomen. In *Æschna* and *Libellula* the alternate contraction and expansion of the abdomen is repeated eighty or ninety times in a minute. With more powerful respiration the abdomen is also alternately contracted and expanded at the sides, and then the lateral margins of the abdomen bend a little downwards during the contraction. This is very strikingly the case in the posterior part of the abdomen in the species of the genus *Æschna*. These respiratory movements are rendered possible partly by the peculiar structure of the abdominal segments, and partly by their tissues and the presence of peculiar muscular bundles in their interior. Each segment, except the first one in male individuals, consists essentially of two very elastic plates or shields of hardened epidermis, of which one forms the lateral and dorsal walls of the segment, and the other, which is much smaller, the ventral wall; these plates are separated at both sides by a space, occupied by a softer skin. At some distance from the posterior extremity of the lower plate there issues on each side a slender muscular bundle, which becomes somewhat broader as it passes upwards and outwards to the other plate of the segment, to which it is attached at some distance from the lower margin. When these bundles contract a little, the lower plate is moved inwards, and the cavity of the abdomen is contracted only from below. If they contract more strongly, not only is the lower plate drawn further in, but the parts of the upper plate which represent the lateral walls are somewhat drawn together and their lower margins pushed over the lower plate, by which the

cavity of the abdomen is contracted from below and also from the right and left. The subsequent dilatation of the abdomen is not effected by any peculiar muscles, but only by the elasticity of the skin.

This rhythmical contraction and expansion takes place even in the second abdominal segment of the male *Libellula*; and by this means the curious sexual apparatus occurring in this segment is set in motion.

The tracheæ have both stems and branches of considerable diameter, and are present in great numbers. Besides these air-vessels, several vesicles of considerable size, which collapse when pricked, belong to the respiratory system: the majority of these are placed in the abdomen.

§ 11. In the *Grylli* and *Acridia* the skin of nearly all the segments of the abdomen is likewise hardened into two separate plates, one of which forms the lateral and dorsal walls; the other, which is much smaller, belongs to the ventral wall. The latter piece is wanting in the first segment, which forms only a half ring; on the last segment it is present, but formed differently from the same part in the intermediate segments, and implicated in the sexual organs. On these intermediate segments there is on each side, between the upper and lower plates, a very considerable space in which the epidermis is soft and thin, and which possesses great extensibility, as may be seen in gravid female *Grylli*. In the genus *Gryllus* the ends of the lower plates reach only to this interspace; but in the *Acridia* the ends of these plates form longer and shorter processes, according to the different segments to which they belong, running upwards over the inner surface of the above-mentioned soft parts, and applying their free ends against the inner surface of the upper plates. The muscles attached to different parts of the abdominal skin, and serving for the most part to produce the respiratory movements, are very different both in number and attachment in *Gryllus* and *Acridium*. In *Acridium*, where they are most simple, we have,—1, a pretty strong muscle on each side springing from the base of the outer surface of the process into which each inferior plate is produced, passing upwards and somewhat backward to attach itself to the upper plate of the same segment; when these muscles contract, the abdomen is narrowed from below, the ventral wall being drawn a little upwards; 2, two other smaller muscles on each side, passing from the anterior margin of the lower plate of each segment thus furnished, forward to the next preceding lower plate; these muscles seem to shorten the ventral wall, and appear to have no essential part in the respiratory process; 3, a great quantity of muscular fibres forming a long and narrow band between every two

approximate upper plates, passing from the anterior margin of each posterior plate to the inner surface of the preceding one; these muscles also take no part in the respiratory movements, but seem to shorten the dorsal and lateral walls. The above description of the muscles applies only to the smaller species of the genus *Acridium*, and not to the larger ones, such as *A. stridulum* and *A. migratorium*. In these there is, on the outer surface of each process of the inferior plates, a tolerably strong, long, bandlike muscle, running from the apex of the process downwards and backwards, and attaching itself to the lower end of the upper plate of the same segment. If all these muscles contract, the ventral wall of the abdomen must be depressed, and the ventral cavity enlarged; so that these muscles must be regarded as inspiratory. Each segment likewise possesses a pair of expiratory muscles, which are also of considerable size and form two flat, broad, and not very long bands, each of which springs from one of the outer margins of the lower plate, and, becoming broader, ascends upwards and outwards to attach itself to the lateral wall of the upper plate of the same segment. There are also muscles similar to those described under 2 and 3 in the smaller *Acridia*; but those of No. 1 are wanting.

In the various species of *Gryllus* (or *Locusta*) we have,—1, muscles which agree perfectly with those described under No. 3 in *Acridium*; 2, on each side of the abdomen there is a simple series of small muscular bundles, which, in position and attachment resemble those described under No. 2 in the *Acridia*. These and the preceding have no particular connexion with respiration. All the other muscles now to be mentioned, on the contrary, are probably devoted entirely to respiration: there is nothing like them in *Acridium*; and they spring from a small and tortuous fold, which is formed by the soft skin between the upper and lower halves of the abdominal segments, and projects a little inwards towards the ventral cavity. 3. A small muscle passes from the above-mentioned fold, inwards, forwards, and downwards, to the lower part of each segment, except the first and the last two. 4 and 5. In each of the same segments two somewhat larger muscles spring on each side opposite each of the preceding, from the fold, pass upwards and outwards, and attach themselves to the end of the upper plate. In the penultimate segment there is only one pair of such muscles. When the cavity of the abdomen is gradually extended, as especially in female insects by the products of the sexual organs, the soft space between the upper and lower plates increases considerably in breadth, and the muscles just described then not only become greatly elongated, but increase generally in size; but when these muscles and, simultaneously with them, those described

under No. 3 are contracted, the cavity of the abdomen is diminished from above and below. 6. A series of seven pretty strong muscular bundles, each of which always lies close behind the other, and has its axis directed from before backwards, covers the greater part of the above-mentioned fold on each side of the body. Each bundle corresponds with an abdominal segment; but whether it is connected with respiration is uncertain. 7. Lastly, wherever two segments are contiguous, a tolerably strong muscle passes transversely from the right to the left fold, and conceals on each side the contiguous extremities of each pair of muscles described under No. 6. When these muscles contract, the folds of skin to which they are attached are drawn a little inwards, and the cavity of the abdomen is narrowed laterally in the neighbourhood of these folds. These latter muscles also are greatly extended when, towards the close of summer, the generative organs are much enlarged and the abdomen is filled with an accumulation of fat, but they are not thereby weakened in their action. Between these muscles and the ventral wall there is a considerable space, in which the chain of ganglia and four very wide air-tubes are situated.

The tracheæ occur in greater number in the *Grylli*; and those which belong to the body-wall, with the exception of their final ramifications, are of considerable diameter, forming elongated and sausage-like tubes. Notwithstanding their width, they do not collapse when cut through, from their having strong and very elastic spiral fibres in them. They also become dilated again after being compressed. There are four or five pairs of vesicular dilatations immediately above the ventral wall of the abdomen, and a pair of much larger ones in the thorax above and behind the first pair of legs. In the *Acridia* the tracheal stems on the walls of the abdomen are fewer, but partly also much wider than in the *Grylli*, and, from their great diameter, their collapsing when cut, and their not expanding again completely when compressed, they form a sort of transition to the air-sacs. Their spiral fibres are comparatively thin and but slightly elastic.

§ 12. It is remarkable that *Acheta campestris*, although externally less nearly related than the *Acridia* to *Gryllus verrucivorus* and others of its genus, nevertheless resembles the *Grylli* much more than the *Acridia* in its respiratory apparatus.

This insect is essentially distinguished from the *Locustæ* (*Grylli*) in the structure of the skin of the abdomen, only by the lower plates of the abdominal segments being proportionally larger and especially longer, and by the first segment possessing a lower plate. Parallel to these plates, but at a tolerable distance from them, there are, as in *Gryllus*, several transversely stretched muscular bundles, passing from the soft parts of one lateral wall

to the same spot on the opposite wall ; and of these, one is always placed where two segments are contiguous. Below them are the ventral chain and two long and wide tracheæ. When they contract, the abdomen is somewhat narrowed from each side. It is narrowed from below by numerous muscles, of which the first segment has two pairs, and all the rest, with the exception of the last, one pair. All these muscles unite the ends of the lower plates with those of the upper plates of the same segments : they lie close to the inner surfaces of the lateral soft spaces. Other much smaller muscles serve to draw inwards these soft spaces, which are of considerable width, and thus also contract the abdomen from above and below. Three of these small bundles pass up from each end of the lower plates and attach themselves to the soft skin ; but one such muscle comes from the extremity of [the upper plate of] each of the same segments and attaches itself opposite to the first, also on the soft skin. The abdomen may be shortened by several muscles which unite together its individual segments : of these, one pair always goes from the end of the lower plate of each segment to that lying immediately before it, whilst others, forming long and slender bands, unite the upper plates of each two segments, as in the *Locustæ* (*Grylli*) and *Acridia*.

The respiratory movements themselves are probably effected exactly as in the *Locustæ* (*Grylli*) ; but the author had no opportunity of observing *A. campestris* alive.

In *Acheta Gryllotalpa*, Fab. (*Gryllus Gryllotalpa*, Lamk.), the skin of the abdomen is formed exactly as in *A. campestris*, but the muscular apparatus of this part is much simpler. The upper plates of the abdominal segments are united to each other as in *A. campestris* ; this is also the case with the lower plates, but the muscles of these are absolutely and relatively much broader and stronger. The muscles uniting the upper and lower plates are not of the same kind in all the segments ; in the two anterior segments they are of the same form as in *A. campestris*, but much stronger ; in the other segments they form broad bundles, of which some fibres run from the upper plate, and others from the lateral soft skin, to the lower plate, and of which some take a straight course, while others appear to cross. The specimen examined had been for several years in spirit, and had become extremely hard.

The tracheæ in both species of *Acheta* are very wide, but never vesicularly dilated.

§ 13. In the broad and rather depressed abdomen of *Mantis religiosa* the lower plates of the segments are nearly of the same length as the upper ones. At the sides a blunt edge is formed by them and the soft skin uniting them. Each of the lower

plates is united to the next one by a pair of rather broad and strong muscular bands (the muscles uniting the upper plates are much weaker); so that the abdomen can probably be a good deal shortened. For the contraction of the abdomen upwards and downwards, several pretty long and almost bacilliform muscles pass from the upper to the lower plates in the vicinity of the lateral margin. The first two segments have each only one pair of such muscles; the segments from the third to the sixth possess each two pair, one close behind the other. The soft skin can also probably be drawn inwards; for on each side of the abdomen are several short muscular bundles, of which one always runs from one end of each lower plate, obliquely from before backwards, and a second, partly covering the former, from behind forwards to the soft skin, to which they are attached. Two other pairs of muscles on each side go from the upper plate to the soft skin—one of these, the largest, from the middle of each plate, the other from its posterior margin.

§ 14. In *Truxalis* the organization of the wall of the abdomen is almost exactly the same as in the larger *Aceridia*.

§ 15. All the *Hymenoptera aculeata*, with the exception of the Ants, have, according to the author, essentially the same organization of the abdomen and respiratory movements.

Each segment, except the first, consists of two very firm plates, generally very broad in proportion to their length, both nearly of the same length, and united at the sides of the body by a softer skin in such a manner that the upper one projects over the ends of the lower one, and therefore the soft skin uniting the two plates cannot be seen from without. All these segments are also pushed into each other like the tubes of a telescope; so that the soft skin uniting them is likewise usually concealed. In most of these insects the anterior angle of each extremity of the lower plates of most of the segments projects greatly, forming a point, directed forwards. (The author observed in a Bee, the species of which he could not determine at the time of making the observation, that between each of these angles and the corresponding end of the upper plate there was a small and nearly lenticular cushion, consisting of a completely closed, white, opaque, and rather firm sac, the walls of which were very thick in proportion to its cavity.)

The respiratory movements are effected with great quickness and vivacity, are rarely interrupted, and give the insect a restless aspect; they consist in an alternate abbreviation and elongation of the abdomen, the individual segments being drawn more deeply one into the other and again pushed out. In those which have the abdomen nearly straight, such as the Wasps, these movements usually take place in a straight direction; but in

those in which the abdomen is more or less curved downwards, as in the Humble Bees and Bees, the abdomen, when extended, is at the same time more strongly decurved.

The shortening of the abdomen diminishes its cavity and causes expiration; its elongation enlarges the cavity, and is connected with inspiration. Sometimes, however, in this latter movement, especially when the insect protrudes its sting, the upper plates of the segments are pushed further over the lower ones, the cavity of the abdomen is contracted nearly as much as it is elongated, and thus the inspiration is hindered; nay, sometimes the upper plates may be so strongly pushed on the lower ones that an expiration must be produced. The shortening of the abdomen (expiration) is effected by peculiar muscles attached to the dorsal, ventral, and lateral walls of the abdomen. The ventral muscles are only of moderate size, and form cords, of which two always run (somewhat converging) from the anterior margin of each segment, nearly to the same part of the preceding one. The dorsal muscles take the dorsal vessel between them, as the ventral ones do the chain of ganglia, and are attached to the upper plates in the same way as these to the lower ones; they are, however, rather thinner. Of the lateral muscles one springs from the upper and anterior angle of each lower plate, except that of the first segment, and passes obliquely downwards and forwards, gradually becoming broader, to the lower plate of the preceding segment; and another, from the lower and anterior angle of each upper plate in the same segments, turning upwards and forwards, attaches itself to the inner surface of the same plate in the preceding segment. Both muscles reach from the segments from which they spring nearly to the anterior margin of the other.

The act of inspiration is effected partly by the elasticity of the softer skin between the segments, but still more by peculiar muscles, of which there are two pairs on each segment, except the first. In most (and probably in all) aculeate Hymenoptera these are much thicker than the muscles just described as being attached to the lateral walls and serving for expiration. The inspiratory muscles are also placed in pairs on each lateral wall of the abdomen; they spring in each segment from the same spots to which the expiratory muscles are attached, but lie behind these, and do not run, like them, obliquely forwards; but, supposing the abdomen in the act of inspiration, the muscle springing from the inferior plate of each segment passes straight down to the hinder margin of the inferior plate of the preceding segment; that springing from the upper plate goes straight up to the hinder margin of the upper plate of the preceding segment. In the state of expiration both muscles are

directed somewhat obliquely backwards from their points of origin.

§ 16. In the Hymenoptera with an ovipositor (*Terebrantia*) the author's observations were made chiefly on *Ophion luteus*, *Ichneumon persuasorius*, and *Sirex gigas*. In these the upper plates of the abdominal segments are considerably larger than the lower ones, and form both the dorsal and lateral walls of the abdomen; the lower plates occupy only the ventral wall. The former also project a little beyond the latter, with perfectly free extremities.

In the respiratory movements the lower plates are usually somewhat elevated and again depressed; more rarely, and only when the respiration is very forcibly effected, the ends of the upper plates are also set in motion inwards and outwards.

The tracheæ are shrub-like; and no air-sacs ever occur.

Details.

In *Ichneumon persuasorius* the lower plate of each of the first eight segments of the abdomen is rather broad; the first is simple, the rest partly hard and partly soft. The harder and thicker parts form three longitudinal bands, of which the broadest occupies the middle of the plate, the others lying close to its lateral margins. Between these and the middle band are two softer bands, which in the specimen examined were a little bent in towards the ventral cavity; so that each plate, viewed from beneath, showed two moderately broad and deep furrows running in the direction of the length of the abdomen. During expiration the entire plate moved upward, and during inspiration downward; and in the latter act the above-mentioned furrows were not unfrequently effaced, so that the plate became quite flat and a little widened. On the abdomen being opened it appeared that on the convex side of each of the furrows there was a longitudinal muscle running from the anterior margin of each plate to the same margin of the following one: from its position and attachment, its contraction must flatten the furrow-like part. A second, shorter and flatter muscle passed from each anterior angle of the lower plates, outwards, upwards, and backwards, to the upper plate of the same segment; these serve for expiration. (Superior longitudinal muscles were also present.)

In the female of *Sirex gigas* the two hindmost segments of the abdomen have no inferior plates; in the other six segments the lower plates are present and very broad. From each anterior angle of these plates a moderately strong expiratory muscle passes upwards, outwards and backwards to the upper plate of the same segment. Another much thicker and longer muscle, also serving for expiration, passes from each posterior angle

of the lower plates upwards, outwards and forwards to the anterior margin of the upper plate, covering the broader upper part of the above-mentioned muscle. There are likewise upper and lower longitudinal muscles for the abbreviation of the abdomen. The lower ones are even doubled—two on each side of the lower plates. They are rather thick, but narrow. The upper muscles, on the contrary, are very broad, but thin and delicate. Notwithstanding these numerous muscles, however, the abdomen is not shortened and elongated for the purpose of respiration, as in Bees and Wasps.

§ 17. The author then discusses the question whether these movements of the abdomen, supposed to be connected with respiration, may not subserve some other function.

1. The pulsation of the dorsal vessel cannot be essentially affected by these movements, as when they cease for a longer or shorter time the activity of the dorsal vessel does not stop. This applies also to the action of the digestive organs, for this likewise goes on, and movements (especially peristaltic) of the intestine and malpighian vessels take place even when the movements of the abdomen cease for some time. There can also be no particular relation between them and the function of the generative organs, as they occur both when the sexual organs are far from maturity and when their activity appears to be purely plastic. There are no other organs in the abdomen of most insects, except the respiratory organs, with which these movements can be connected.

2. As the latter organs are surrounded by structures far less compressible in their nature, it is clear that as the walls of the abdomen contract, the air contained in the respiratory organs must be set in motion and partly expelled through the stigmata.

3. The movements of the walls of the abdomen, in those insects in which they occur, take place, like the respiratory movements of higher animals, more rapidly when the insect makes, or endeavours to make, greater muscular exertions; hence we may conclude by analogy that there is a close relation between the movements in insects and those in vertebrate animals.

4. In *Cetonia aurata* and *Scarabæus stercorarius* the author convinced himself by observation that these movements truly act upon the respiratory organs. On cutting off first the wings and wing-cases and then the upper wall of the thorax from these Beetles, he saw that every time the dorsal wall of the abdomen was depressed the air-sacs contained in the thorax became tensely dilated, and when the dorsal wall again rose these air-sacs became a little smaller.

5. In *Acridium stridulum* he remarked that, whenever the abdomen contracted, the two pad-like and closely appressed lips of

each of the stigmata placed above the intermediate legs separated, indicating that a portion of the air contained in the thorax was driven out through them. The same phenomenon was observed in the stigmata above the posterior pair of legs in *Gryllus verrucivorus*.

§ 18. Distinct movements of the walls of the body are not seen in every perfect insect, even when observed for a long time ; and hence it might be supposed that the tracheæ and air-sacs in many (or perhaps in all) insects may be capable of contracting and dilating themselves by the tone and elasticity of their tissue. Elasticity is certainly possessed in a high degree by all those tracheæ which are not too wide in proportion to their length, or too thin-walled in proportion to their width, as may easily be seen in any such vessel, even of a recently killed insect, by compressing it and then removing the pressure. All parts of the respiratory system also possess a greater or less degree of physical contractility according to their different nature. It is greatest in the tracheæ, as these, when extended in width, or still more in length, contract again to their previous dimensions ; it is least in the air-sacs, which, when dilated, contract but little and scarcely perceptibly on the removal of the cause of the extension. A tone, or organic contractility, seems on the contrary to be entirely wanting in all these parts. This view the author supports by the following observations. Of several living insects, especially *Grylli*, *Acridia*, *Scarabæus stercorarius*, and *Carabus granulatus*, he opened the abdomen, and observed particular parts of their respiratory systems under the action not only of the air, but also of cold water, concentrated sunlight, and mechanical irritants, sometimes with a very strong lens and sometimes with the microscope, without ever remarking a contraction which indicated any tone of these parts. Nor could he observe any such contractions in the tracheæ of *Tenebrio molitor*, by examining them through the transparent parts of the skin of that insect. Hence he considers that we are justified in stating that respiration (and especially expiration) is never effected in any insect by the proper powers of the tracheæ and air-sacs alone, but that they require a pressure exerted upon them by other surrounding structures. This pressure can be exerted only by the wall of the abdomen, or in some insects by that of the metathorax ; for although some of the viscera by their own activity may be capable of exerting a pressure upon them, this must be much less than that of the wall of the body. If no respiratory movement of the wall be observed in a perfect insect, the cause of this may be various.

1. The insect may be too small, and the movement too slight, to allow its observation ;

2. Or it may be too hairy or plumose to allow such a movement to be perceived by the eye ;

3. Or it may have fasted for a long time, rendering the movements so few and weak as to escape observation ;

4. Or the insect may be rendered dull and weakly by other causes.

Here the author remarks that in insects in general respiration by no means plays so great a part, and, although necessary, is not so important as in birds and mammalia*. Many proofs of this assertion are to be found, according to the author, in Sorg's memoir, 'Digestiones physiologicæ circa respirationem insectorum et vermium' (Rudolst. : 1804) ; and he cites the circumstance that many insects live in the earth or in rotten wood, where they cannot possibly obtain an abundance of pure air for their respiration. He also cites the observation of Sir Humphry Davy ('Consolations in Travel,' Dialogue 2), that on the small floating islands of *Confervæ* in a lake near Tivoli he found an immense number of the most various insects, although this lake exhales so much carbonic acid and sulphurous vapour, that the aquatic birds, which sometimes visit it, remain on its shores, because, on the lake itself, these vapours would be fatal to them. Moreover his own observations show that in many insects the respiratory movements are few and weak.

If the above-described movements of the abdomen have really an influence upon respiration, this must be a double one, in con-

* In a note subsequently written, the author observes:—"This is going too far, as appears from the experiments of Treviranus on the respiration of the lower animals (Treviranus and Tiedemann's 'Zeitschr. für Physiol.' Bd. iv.).

"Results.—1. The quantity of oxygen taken up and of carbonic acid exhaled by the same insect is very different in equal times, according as it moves or rests, according as it is exposed to a higher or lower temperature (greater in the former case), and according as it is full-fed or fasting.

"(In *Apis terrestris* the quantities of carbonic-acid gas exhaled at 9–12° R. and 14–23° R. are as 22 : 174.)

"2. The quantity of carbonic-acid gas produced in respiration differs in different insects. The most active insects exhale the most carbonic acid. Among these are the Bees, Humble Bees, and Lepidoptera. These are followed by the *Syrphi* and probably many other Diptera. Then come the *Libellulæ* and Beetles. The smallest amount of carbonic acid is exhaled by the larvæ of Lepidoptera and Beetles. A larva of *Cetonia aurata* does not exhale a fifth of that produced by the perfect insect of the same species.

"3. When the temperature of the air is 11½° R. the Bee produces nearly as much, and at a temperature of 22° R. far more carbonic acid than even the Dove. *Papilio Atalanta*, even when it has been for several days without food, exhales a far greater quantity of the gas at 15° R. than that bird. Cats, Guinea-pigs, and Rabbits are inferior to Humble Bees in strength of respiration at a temperature of 16–17° R. At this temperature *Syrphus nemorum* is about equal to those animals."

sequence of the structure and distribution of the respiratory apparatus.

1. In the abdomen itself. When its cavity is diminished, the tracheæ, and the air-sacs when they occur, must be somewhat compressed and a portion of the air contained in them driven out through the stigmata. But when the cavity of the abdomen enlarges again, and the pressure exerted upon the air-passages contained in it is removed, these must furnish an entrance for the atmospheric air, partly because the pressure of the external air overcomes that upon the outer surface of the air-vessels, and partly because the tracheæ at least may again dilate by their own elasticity.

2. As regards the head and thorax, which, if we except the thorax of the *Staphylini* and *Carabidæ*, cannot expand and contract. A portion of the air contained in the abdomen will be driven into them through the air-vessels when the abdomen contracts. A portion of this air then flows out through the stigmata of the thorax (as is seen in the *Locustæ*), but another portion inflates the air-passages of the thorax and probably those of the head to a greater or less extent. When the pressure on the abdomen ceases, the tracheæ and air-sacs of the thorax and head contract by their proper elasticity, and again expel a portion of their contained air, probably in part through the thoracic stigmata, at least in those insects whose stigmata are constantly open, and in part back into the abdomen.

The same applies probably to the movement of the air to and from the extremities.

§ 19. In all the insects examined, except the Hymenoptera, only the contractions, and not the dilatations, of the abdominal cavity are effected by the action of muscles. The means by which the cavity is enlarged and the inspiration effected, appear to be various in different insects and even in the same insect.

1. In those insects which only possess shrub-like tracheæ, the latter appear to be a principal means of the dilatation of the abdominal cavity during inspiration. The tracheæ, like the arteries of the Vertebrata, possess a high degree of elasticity, and, even after the insect's death, regain their volume, after being compressed, as soon as the pressure is removed. As they are undoubtedly compressed, directly or indirectly, by the walls of the abdomen during expiration, it is to be expected that, when this pressure ceases, they will again expand, react upon the walls of the abdomen, and push these somewhat apart. This applies also to most of those insects which possess vesicular as well as ramified tracheæ, and especially to those in which the former are not too wide in proportion to their length. It is less applicable to those whose vesicular tracheæ are very wide in pro-

portion to their length, as is the case in the *Acridia*: these tracheæ, when compressed and emptied of air, do not completely recover their original diameter by the agency of their proper elasticity. The air-sacs, which exist in greater or less number in many insects in connexion with the tracheæ, usually consist of an extremely delicate membrane, in which no trace of a spiral fibre can be detected: when strongly dilated with air, they may certainly contract a little by their proper contractility, if the pressure from within ceases; but when compressed from without, they cannot dilate themselves again by virtue of any inherent elasticity. Consequently in those insects which have air-sacs or very wide vesicular tracheæ in the abdomen, these structures cannot contribute to the dilatation of the ventral cavity.

2. In those insects in which during expiration the extremities of the upper halves of several abdominal segments are bent somewhat inwards (as in the *Grylli*, *Acridia*, *Libellula*, *Tabani*, some Beetles [*Carabus granulatus*] and many Lepidoptera), these extremities, when the muscles cease to act upon them, move apart again by their own elasticity, and thus assist in enlarging the abdominal cavity.

3. In those insects in which the softer skin between the upper and lower halves of the abdominal segments possesses considerable thickness and elasticity, and folds inwards during expiration, it appears, during inspiration, to press outwards again by its own elasticity, recovering the plane in which it is stretched during repose, and pushing apart the upper and lower plates of the segments. In those, on the contrary, in which this skin is comparatively thin and does not fold during expiration (as in *Tabanus*, *Musca*, *Tipula*, and the Beetles), it probably does not act in the above way in the dilatation of the abdominal cavity. For the contractility of this portion of the skin is very considerable, and it may therefore be supposed that when it has been somewhat compressed during expiration, it will again extend itself on the cessation of the pressure.

§ 20. From the statements contained in the preceding paragraphs we may understand how the process of inspiration goes on in perfect insects.

1. In those which possess only shrub-like tracheæ, these expand by their own elasticity as soon as the direct or indirect pressure of the abdominal walls producing expiration ceases, and by their proper force cause the atmospheric air to place itself in equilibrium with the air contained in them and penetrate through the stigmata. If the abdominal walls also expand by their own elasticity after the completion of expiration, this dilatation can only be regarded as a removal of the obstacles to the independent dilatation of the tracheæ.

2. In those, on the contrary, which possess air-sacs as well as tracheæ, or in which some tracheæ are very wide in proportion to their length, the walls of the abdomen cause the inspiration, either by their proper elasticity or, as in the Hymenoptera, by muscular power.

§ 21. It is well known that insects when fully fed, and requiring a greater amount of oxygen for the purpose of digestion, respire far more frequently than when their alimentary canal is empty; the respiratory process also appears, at least in the greater number of insects, to take place more completely and powerfully. The movements of the abdominal plates and the extension of the soft skin uniting them are then far greater than when the alimentary canal is empty. The muscles moving these parts will be more stretched than usual, and therefore will contract to a far greater extent; so that the difference between the size of the abdominal cavity in inspiration and expiration is increased, the air-passages are more strongly compressed, the air contained in them more completely evacuated at each expiration, and a greater quantity of fresh air is taken in during inspiration, than under other circumstances. This at least must be the case with those insects which possess only ramosæ tracheæ. It probably applies also to these insects at the time when their generative organs, especially in the female, are much dilated and the abdomen inflated thereby; but it is not known whether at this time, if the alimentary canal be empty, the respiration goes on more rapidly than before, when the sexual organs had attained no great size. The same theory cannot apply to those insects which possess vesicular tracheæ or large air-sacs, as these vesicles are not so elastic as to be capable of dilating again by their own powers on the cessation of pressure. Perhaps these insects, under the above circumstances, breathe more rapidly than the others. The author considers that many of his observations are in favour of this view.

§ 22. Is that movement of the abdomen of insects which is connected with respiration a voluntary or an involuntary act? This question is to be answered in the same way as the similar one relating to the respiration of man.

After the decapitation of insects (*Grylli*, *Scarabæi*, *Tabani*, and Wasps) the abdomen has been seen to continue for a time contracting and dilating in the same way as before the injury, from which the author concludes that in these the respiratory movements may go on quite involuntarily. But these movements not unfrequently cease for a longer or shorter time in uninjured insects, or they are limited to one or two segments; and the contractions take place in these with unusual exertion, although the remainder of the segments which otherwise act in respiration

remain quite quiet: from this we may conclude that the will may exert some influence on the respiration.

§ 23. Certain phenomena lead to the belief that in many insects various viscera have a subordinate action upon the respiration of insects, or at least upon the *distribution* of air in them.

1. The pulsation of the dorsal vessel sets a number of tracheæ in motion, pushing them forwards and backwards, extending them in length, and then permitting them to contract or contort themselves again.

2. In those insects which possess a sucking-bladder connected with the anterior part of the alimentary canal, this must produce similar, but sometimes, by lateral pressure, still greater effects upon the tracheæ and air-sacs in its vicinity: in many such insects, especially Diptera, this bladder, which is sometimes of great size, may be seen, even through the skin, slowly but incessantly contracting and expanding alternately to a very great extent.

3. This applies also to the intestine and, although in a far less degree, to the malpighian vessels, which, as may be ascertained not only from opened insects, but also from many uninjured ones (such as some species of *Syrphus*), are constantly performing peristaltic movements. The strongest peristaltic movements, which indeed were perceptible through the walls of the abdomen, were observed by the author in *Ophion luteus*. In the first segment of the abdomen, in which the intestine was quite straight, they went on unceasingly, in such a manner that the portion of intestine contained in it always remained straight; in the remainder of the abdomen, in which the intestine is much contorted, they took place only at intervals, but each time with great rapidity and violence, the intestine undulating to and fro to a remarkable extent.

By the dragging of these viscera upon the neighbouring and attached tracheæ, and also by the pressure which some of them exert during their extension upon air-sacs in their vicinity, it cannot be but that the air contained in these parts will be set in motion. Partial movements of the air in the interior of the insect must also be produced during the action of the muscles of the limbs, as these muscles are penetrated and surrounded by many air-vessels.

II. IMPERFECT INSECTS.

A. Of those which only undergo a partial metamorphosis.

§ 24. The structure of the abdomen in the young of *Blatta*, *Gryllus* and *Acridium* is similar to that occurring in the perfect insects; so that it is probable that the respiratory process is the same in both.

B. Grubs and Caterpillars.

The tracheæ of these larvæ were examined immediately after they had been opened down the back, both with the simple lens and with the microscope, but no contractions could be observed in them even when irritated mechanically or with alcohol.

§ 25. The larvæ of *Vespa crabro* and *V. vulgaris*, both when within their cells and after removal therefrom, frequently shorten and elongate their bodies, at the same time curving them laterally either to the right or left. In the latter movement the convex half of the body also becomes smoother, and the concave half thicker than before, a portion of the fat and other structures contained in the body being pressed from the former into the latter.

The skin between each two contiguous segments is somewhat thinner and softer than in the segments themselves, and at the point where the upper and lower halves of each segment come together the skin is likewise thinner and softer, and forms a projecting fold. From the entire anterior margin of each segment, except the two soft spaces on the right and left sides and the spaces where the dorsal vessel and ventral ganglionic cord lie, there runs a great number of nearly straight and pretty thick muscular bundles, forming two superior and two inferior layers; these pass nearly to the corresponding margin of the preceding segment, and not only shorten the body, but also, by acting on one side, curve it to one side. Besides these, on each side, partly from the upper end of the lower half of each abdominal segment close to the soft skin, and partly from this soft skin itself, two delicate and closely approximated muscular bundles pass inwards and downwards to the lower half of the preceding segment, attaching themselves partly to the anterior margin of this in the vicinity of the ganglionic chain, and partly running further inwards and forwards to apply themselves to the upper surface of the straight muscles of the next anterior segment. These latter muscles may flatten the body, and appear to be antagonistic in the two halves of the body; so that when those of the left side contract, those of the right side are relaxed, and *vice versa*. The straight longitudinal muscles are likewise antagonistic in the two sides of the body. When the entire body contracts in the direction of its length, during which the segments themselves, consisting only of a soft skin, are somewhat shortened, it is extended again, after the relaxation of the muscles, only by the elasticity of the cutis and of the contents of the cavity.

All the tracheæ are ramose, and all the stems of each side of the body are united, as in the perfect Wasps, by a com-

mon cylindrical and elastic canal, which, however, is only of moderate diameter.

The respiratory process in these larvæ can only be effected by the above-mentioned movements, both general and partial. If the larva contracts longitudinally, when it does not gain so much in breadth as it loses in length, the contents of the body-cavity, and therefore the tracheary system, must be compressed, and the air contained therein driven out of the stigmata, in larger or smaller quantity according to the shortening. On the cessation of the activity of the muscles, the air-vessels, being freed from the previous pressure, must dilate again by virtue of their elasticity, and cause the air to enter through the stigmata. The same process of expiration must also take place when the larva bends strongly to one side; for as the convex side then becomes smoother, and the structures contained in it are partially driven over into the opposite side, it is more than probable that its tracheæ also are then compressed and partly emptied of air; and as the concave side is shorter and moreover filled with a portion of the structures from the other side, its tracheæ also must be compressed and compelled to part with their air.

§ 26. In the larvæ of the *Scarabæi*, or at least in that of the May Bug (*Melolontha majalis*), the epidermis of each abdominal segment, except the last, forms two moderately firm plates, the upper a little larger than the lower, united at each side by a thinner and more flexible part of the epidermis. In these softer parts are the stigmata. Both the upper and lower plates of every two segments move upon each other by means of several muscular bundles, of which some, and these the innermost, immediately surrounding the abdominal cavity, run straight forward from the hinder margin of one segment to the same margin of the other, whilst others take an oblique direction from within outwards and forwards, and others from without inwards and forwards. Of these oblique muscles some have the same insertions as the straight muscles, but others pass from the middle of one segment to the hinder margin of the preceding one. In each abdominal segment, except the last, there are also two, and in some even three pairs of pretty strong muscles, which all run from the ends of the upper plate, over the softer parts of the skin, inwards and downwards. Those of the inner pair pass straight to the lower plate of the same segment, and are attached to this; those of the other one or two pairs run obliquely forward, and attach themselves to the lower plate of the preceding segment. The hindmost segment has only one pair of muscles, and these are oblique.

By the muscles running obliquely from above downwards and

inwards the segments of the abdomen may be rendered flatter, and by the others it may be shortened. By means of these latter muscles, moreover, the larva is enabled to curve its body sideways, upwards, and downwards. It is also of great importance to the larva, both in shortening and bending its body, that the epidermis and cutis of each segment form several small folds directed towards the body-cavity.

In examining a living strong larva, it will be seen that it not unfrequently flattens its body greatly in places, and at the same time narrows it from the sides, and that this contraction of the body usually advances from before backwards over the different segments, no more than a few segments being contracted at the same time. The larva can likewise considerably shorten its body, when the increase of thickness does not appear to compensate fully for the abbreviation. But more commonly, and indeed when the larva endeavours to crawl, only partial shortenings of the body take place.

§ 27. The expirations must take place, theoretically, as in the Wasps and other Hymenoptera, when the body shortens, the individual segments not gaining so much in width as they lose in length, and also when the body curves to one side, but still more when it is flattened from above and below. These views are confirmed by Bonnet's experiments on the respiration of Caterpillars. According to these experiments, when Caterpillars are immersed in water, more numerous and larger air-bubbles escape from the stigmata the greater the movements made by the animals. The inspiration must of course take place when the pressure upon the air-vessels, produced as above, ceases.

As, moreover, the movements perceptible in the body-wall of Caterpillars and the larvæ of Beetles and Diptera are chiefly connected with the locomotion of these animals, it follows that their respiration is also chiefly connected with their locomotion.

All respiration in these animals is subjected to the will, and never involuntary.

§ 28. The Caterpillars of the Lepidoptera can shorten and elongate their bodies considerably, but can neither flatten them nor contract them at the sides in the same way as the larvæ of the *Scarabæi*. When they shorten themselves, the individual segments increase in width, but by no means sufficiently to compensate for the shortening. This applies also to the narrowing of the segments when the Caterpillar elongates itself. Some segments are usually elongated at the same time that others are shortened; and the two processes take place progressively from before backwards. This at least is the case during the locomotion of Caterpillars.

C. *Pupæ and Nymphæ.*

§ 29. In undisturbed pupæ of Lepidoptera no movements of the body are to be detected, and therefore no movements that can be referred to the act of respiration. The same thing applies to the pupæ of Beetles, Hymenoptera, and probably of other orders of insects. Nor can it be perceived, on opening such pupæ and irritating their tracheæ in various ways, that these vessels contract or dilate.

From the absence of all such phenomena we might conclude that in the pupæ of the above-mentioned insects the tracheary respiration is entirely interrupted. But, according to Sorg's observations, pupæ of Lepidoptera and Ants die, although not for some time, when kept in small receivers from which the external air is completely excluded; and these creatures consume a small quantity of oxygen, and give out a little carbonic acid. According to the observations of Reaumur and Martinet also, pupæ die when their stigmata are covered with oil. If these observations be correct (and there seems no reason to doubt them), the phenomena in question may be ascribed to two causes. In the first place, it is possible and conceivable that the air may penetrate the envelopes of the pupæ as readily as those of birds' eggs, and then enter into a mutual action with the internal parts of the insects. The permeability of these envelopes by air and vapours is indicated by the fact that when dead larvæ or pupæ are exposed to the air, they dry and lose considerably in weight. In the second place, as the pupæ are not always exposed to the same temperature, the air contained in their tracheæ must undergo changes in its density; and in consequence the tracheæ must sometimes give out a portion of their contents, and sometimes draw in a portion of the external air.

In any case it is certain that the respiration of pupæ can only be very weak. This is shown by the observations of Sorg, and also by the circumstance that the pupæ of many insects, *e. g.* the Bees, are enclosed in a nearly air-tight case, whilst others lie deep in the earth. This weak respiration in pupæ is remarkable, inasmuch as it is in them that the most important changes in the form and number of the different parts of the body takes place. But it will not be difficult to give a satisfactory explanation of these phenomena.

During the evolution of an insect within the pupa-skin, nearly all the fat and likewise a quantity of muscles and other structures disappear, but the materials of these parts pass into new combinations and serve for the evolution or even for the formation and evolution of other organs. They contain more or less oxygen in their composition; and it is conceivable that this may suffice to

render the taking in of any considerable quantity of oxygen from the atmosphere unnecessary. Analogous phenomena are presented by hybernating Mammalia and Reptiles, as in these, during hybernation, respiration is almost entirely suppressed; and nevertheless whilst the fat so abundantly deposited almost entirely disappears, some of the other organs, especially the testes and seminal vesicles in the Mammalia and the ovaries and oviducts also in the Reptiles, are considerably increased in size and gradually prepare a great mass of their secretions. It is, as many phenomena indicate, the exaltation of nervous action and the activity of the muscles that give rise in animals to a greater consumption of atmospheric oxygen, and therefore to a more rapid and powerful respiration, in order to replace the wasted portions of the nervous and muscular systems; far less oxygen is required by the lower constituents of the organism to maintain themselves in action or even to develop themselves further.

§ 30. Lastly, the question is to be answered whether insects both inspire and expire the air through all their stigmata.

Beautiful investigations for the solution of this question are to be found in one of Bonnet's memoirs*. Bonnet's principal observations are as follows:—

1. If a Caterpillar be immersed in water so that only the hindmost pair of stigmata are left free, it survives this experiment for some time, whilst it soon dies if entirely immersed.

2. It also lives for some time if immersed so that only its anterior pair of stigmata remain free.

3. When a Caterpillar is entirely immersed in water, an air-bubble is not unfrequently seen to issue from one or other of its stigmata, most commonly from one of the foremost or hindmost pairs, and this is then alternately drawn in and pushed out.

4. When the stigmata of the foremost and hindmost pairs in a Caterpillar are clogged with butter, and the rest left free, the animal is more uneasy than when the experiment is reversed.

From these experiments it follows that Caterpillars inspire and expire by all their stigmata, but most through those of the foremost and hindmost pairs.

Moreover it is inconceivable that the whole mass of inspired air should be expired by other ways than those through which it entered the body. This would be in opposition to the entire structure of the respiratory system; for in a great number of insects the stigmata are so constructed that they cannot be closed by the animal, and consequently furnish the air with a means both of entrance and exit.

* Mém. de Math. et de Phys., vol. v. In *Acridium stridulum* the stigmata above the intermediate pair of legs appear to expire only, and not to inspire.

XIII.—On Villaresia.

By JOHN MIERS, F.R.S., F.L.S. &c.

THIS genus of the Flora Peruviana is but little known, only one species having been yet described. Poiret (in 1808) considered it to belong to *Aurantiaceæ*,—an idea derived, no doubt, from the vernacular name of the typical species, "*Naranjillo*." Jussieu (in 1821) gave a very correct description of that species, accompanied by analytical figures (Ann. Sc. Nat. xxv. tab. 3), and placed the genus rightly in *Aquifoliaceæ*. Don (in 1832) described the same plant under the name of *Citronella mucronata*, when he assigned it a position near *Cassine*. Hooker and Arnott (in 1834), in their enumeration of Chile plants (Hook. Journ. Bot. i. 283), arranged the genus next to *Myrsine*. Jussieu states that some botanists had considered it as belonging to *Menispermaceæ*; and Dr. Lindley (in 1836) appears to have then adopted similar conclusions in referring it to *Schizandraceæ* (Introd. Bot. 553), but afterwards (in 1846) he retracted this opinion (Veg. Kingd. 598), and, following the view of Jussieu, placed it in *Aquifoliaceæ*. Endlicher pursued the same arrangement in his 'Gen. Plant.' No. 5709.

On a former occasion, I adduced abundant evidence to show that the *Icacinaceæ* do not belong to *Olacaceæ*, and that the proper place of that family in the system is near the *Aquifoliaceæ*, the structure in both cases being nearly similar, differing principally in the æstivation of the corolla, which is valvate in the former and imbricate in the latter. In both families the ovarium is normally plurilocular; and when, as in *Villaresia*, it is one-celled, this is always due to the abortion of the other cells—a condition that also prevails throughout the *Icacinaceæ*; it therefore very rarely happens that more than one cell and a single seed are perfected in this genus. I have recorded the fact* that in *Pennantia*, where the fruit is generally unilocular and monospermous, it sometimes occurs that two cells, each 1-seeded, are developed. I have witnessed the same exceptional occurrence in *Villaresia*, in a species growing at Kew, where, on the same plant, some of the ovaries were 1-locular, while others were distinctly bilocular, each with two ovules collaterally suspended from the dissepiment. Hence the rule is general throughout both families, that, although the normal condition of the ovary is plurilocular, there exists a general tendency to the abortion of most of its cells. Thus in *Ilex* we have constantly four, or more rarely five, cells, in *Prinos* six to eight, in *Cassine* three, in *Nemopanthes* three or four, while in *Byronia*

* Huj. op. ser. ii. p. 488; Contrib. Bot. i. 77, pl. 12. figs. 25–28.

they number from twelve to sixteen; in *Villaresia* it is almost universally 1-celled, as also is the case in *Ætotoxicum*, which appears to belong to the same family. Although, as I have mentioned, the ovary in the *Icacinaceæ* is generally unilocular, it is constantly 3- or 5-celled in *Emmotum*.

Throughout both families there is a general tendency towards the suppression of one of the sexes, so that the flowers are always more or less polygamous; and this is carried to such an extreme in *Ætotoxicum*, that they are constantly dioecious, when in all other respects the structure corresponds with the *Aquifoliaceæ*. On the other hand, perhaps no genus in the family approaches nearer to regular hermaphroditism than *Villaresia*.

One great peculiarity attends the development of the ovary in this genus: the suppressed cells united in the normal axis form a prominent longitudinal parietal expansion, which extends far towards the centre of the single fertile cell; and from near the summit of this expansion the two collateral ovules are suspended. In the fruit, only one of these ovules arrives at maturity, and that soon fills the entire cavity; the seed therefore moulds itself about the placental expansion, becoming thus bent round it, so that its transverse section is hippocrepiform. A similar structure occurs in *Bursinopetalum*, as is well shown by Dr. Wight, in his 'Icones' (tab. 956). This latter genus is referred by Dr. Wight to *Olacaceæ*, but it cannot belong to that family, on account of the structure of its ovary and the mode of suspension of its ovules, in which respects there is a perfect analogy to the structure of *Villaresia*.

I will shortly detail the observations I have recently made on the peculiar structure of *Bursinopetalum*, and will endeavour to indicate its real affinity.

Although, as before stated, the æstivation of the petals in *Villaresia* is broadly imbricative, their summits are always inflected and folded into each other, so that it is sometimes difficult to unravel a bud. This occurs also in *Bursinopetalum* and in other genera of the family, as in the male flowers of *Ætotoxicum*, for example. The greater or less degree of inflection of the summits of the petals is nearly universal in the *Icacinaceæ*, and this occurs sometimes to a great extent; but as the æstivation there is completely valvate, the separation of the parts in the bud is quite easy.

Another peculiarity exists in *Villaresia*—the presence of hollow glands imbedded in the parenchyma of its leaves, each with a pervious opening on the lower face, always situated within the axils of the primary nerves or in the sinus of their first bifurcations: this peculiarity is not confined to the typical species in which I first observed it. Ruiz and Pavon notice the occurrence,

which they attribute to the work of insects; but this is not probable, because these porous glands present themselves regularly in the axils, exactly in the same position, and appear as constantly in the several Brazilian species as in those of Chilian growth. Sometimes the base of the nerve, where it joins the midrib, is expanded like a lamellar plate, forming a hollow pouch beneath it, with the porous aperture in its mouth; generally the hollow within the parenchyma is not much larger than the open pore itself.

Villaresia was considered to be a genus peculiar to Chile, but it has since been found in the Banda Oriental and in Southern Brazil, and even within the tropics as far as 15° S. lat. These Brazilian plants have all been considered by Reisseck as identical with the type of Chilian growth; but the characters here given show them to be specifically distinct. In habit they all much resemble those of *Ilex*, the leaves in some species of both genera being often spinoso-dentate; in others they are quite entire. It is probable that they contain *theine*, as in *Ilex Paraguayensis* and other species of that genus; for the leaves of the *Ilex Congonha* of Martius, which is a species of *Villaresia*, are used in Brazil as tea, the Brazilian term *congonha* being synonymous with the word *yerba*, as the tea of Paraguay is called. It may sometimes be difficult to distinguish the plants of *Villaresia* from those of *Ilex*; but a ready test is always to be observed in the flower, the pistil in the former genus being furnished with a lengthened style, while in the latter the stigma is always quite sessile: the fruit of the one can never be confounded with that of the other. Many of the Brazilian species have much larger and thinner leaves, and the inflorescence is frequently terminal in subfasciculated spikes: they bear much the appearance of *Leretia*, a Brazilian genus of the *Icacinaceæ*—a family differing chiefly from the *Aquifoliaceæ* in the æstivation of the corolla and the mode of development of the fruit. In the before-mentioned species of *Villaresia* growing at Kew, where some of its flowers had a 2-celled ovary, with two ovules in each cell, suspended from the summit of the dissepiment, I found that, in this case, it had two styles.

All the species belonging to the genus form erect trees having straight trunks, with copious frondose heads; but Prof. Reisseck states, in his generic diagnosis (in Mart. Flor. Bras. fasc. xxviii. p. 75), that the plants are sometimes scandent. From this it may be inferred that he alludes to the *Villaresia scandens* of Hasskarl; but that plant (from Java) cannot belong to the genus, nor even to the same family*.

* In *Retzia*, i. 152; Walp. Ann. iv. 431: it differs from *Villaresia* in its scandent habit, its 2-locular ovarium with only a single pendent ovule in

The following emended generic characters are founded on my own observations, except those of the fruit and seed, which are copied from the description of Jussieu.

VILLARESIA, R. & P.;—*Citronella*, Don;—*Flores* hermaphroditi vel rarius polygami. *Sepala* 5, acuta, imo connata, æstivatione imbricata, persistentia. *Petala* 5, libera, sepalis alterna, oblonga, nervo mediano prominulo intus instructa, margine tenui, undulato-crenata, æstivatione quincuncialiter imbricata, apicibus valde introflexis et inter se complicatis. *Stamina* 5, cum petalis alternantia, et iis paulo breviora; *filamenta* complanato-subulata; *antheræ* introrsæ, cordato-reniformes, 2-loculares, longitudinaliter dehiscentes. *Ovarium* sessile, conicum, sæpius subgibbum et 1-loculare, intus carina parietali (e loculis abortivis in axem centralem congestis) valde prominente notatum, *ovulis* 2 collateralibus a summo carinæ suspensis; vel rarius complete 2-loculare et *ovulis* 2 collateralibus in quoque loculo ad apicem dissepimenti affixis. *Stylus* brevis, crassiusculus, in ovario uniloculari unicus sublateralis; in ovario 2-loculari styli 2; *stigma* obliquum, obtusum. *Drupa* globosa, parce carnosa, endocarpio lignoso semisepto longitudinali superne latiore, incomplete 2-loculata, abortu monosperma. *Semen* cavitati loculi conforme, hinc circa semiseptum longitudinaliter plicatum; *integumenta* dupla, tenuia, interius in rimulas albuminis immissum; *embryo* intra *albumen* copiosum carnosum apicem versus nidulans, parvus; *radicula* supera, teres, *cotyledonibus* complanatis orbiculatis duplo longior.

Arbores vel arbusculæ *Chilenses et Brasilienses, sempervirentes*; folia alterna vel subopposita, elliptica, integra, vel spinosodentata, sæpe rigide coriacea, glaberrima, petiolata; inflorescentia axillaris vel terminalis, sæpius spicatim racemosa; flores albi, parvuli, citriodori.

1. *Villaresia mucronata*, R. & P., Flor. Per. et Chil. iii. 9, tab. 231; A. Juss. Ann. Sc. Nat. xxv. 14, tab. 3. fig. 2; Gay, Chile, ii. 12; Reiss. in Mart. Flor. Bras. fasc. xxviii. p. 75 (in parte);—*Citronella mucronata*, D. Don, Edinb. Phil. Journ. xiii. 243;—*Citrus Chilensis*, Molina;—ramulis flavidis, opacis, striatulis; foliis

each cell, and its exalbuminous seed with large fleshy cotyledons. On this account it seems more likely to be allied to *Chailletia*, with which it appears to agree in the structure of its flower and fruit. I know the plant only from description: from its glabrous leaves, white corymbose flowers, which are free, and not connate with the petiole, its entire petals, and simple long glabrous style, it is perhaps near to, if not identical with, *Chailletia* (*Dichapetalum*) *Timoriensis*, DC., with which it also agrees in its geographical position. The *Chailletia dichapetalum*, R. Br., from Madagascar, is scandent.

ovato-oblongis, apice longe mucronatis, utrinque acutis, interdum imo obtusioribus, coriaceis, margine cartilagineo integris vel rarius subsinuato-dentatis et obsolete spinosis, supra lucidis, læte viridibus, subtus pallidioribus, opacis, costa mediana prominente; nervis anastomosantibus venisque reticulatis utrinque prominulis, subtus in axillis et in dichotomiis nervorum glandula cava immersa poro aperto donatis; petiolo brevi, rugoso, sub lente puberulo; paniculis terminalibus, folio multo longioribus, spicatum racemosum; rachi flava, tomentella, ramis 3-floris patentibus calycibusque pubescentibus; petalis flavido-albis, glabris, odoratissimis; drupa olivæformi.—Chile, v. v., in provinciis centralibus *Naranjillo* dicta, in australioribus *Guilli-patagua* nuncupata.

A tree growing in the central provinces of Chile, and extending as far to the southward as 35° lat.: it grows to the height of 10–20 feet. In the Viceroy's report to the King of Spain, enumerating the useful trees and shrubs of Chile, the *Naranjillo* of Aconcagua is said to be 50 or 60 feet high, and of sufficient girth to furnish logs 18 inches square and 21 feet in length. I have never seen or heard of its attaining any approach to that size. It has an erect trunk, with a broad spreading head and copious foliage. The wood is white and tough, with a fine grain, and is easily worked; when sawn, it makes good barrel-staves. The leaves are thick and rigid, of a pale, bright, shining green, generally elliptic and acute at both extremities, with a sharp mucronate apex, a thick yellowish cartilaginous border, which is generally entire, rarely obsoletely spinose, $1\frac{1}{2}$ – $2\frac{1}{2}$ inches long, $\frac{3}{4}$ –1 inch broad, on a fleshy thickened petiole 2 lines long. The terminal inflorescence is a spicated raceme, ferruginously pubescent, 3 or 4 inches long, its numerous alternate branchlets, bracteate at base, being very patent, and 4–6 lines long, each bearing at its apex 3–6 almost sessile flowers; the sepals are suborbicular, pilose, with ciliate imbricated margins, $\frac{1}{2}$ line diam.; the petals are oblong, 2 lines long, 1 line broad, cuneate at base, internally furnished with a raised carinated nervure, the margins crenated, broadly and quincuncially imbricated in æstivation, the summits of the three more internal ones being inflected and plicated together; the stamens are about two-thirds the length of the petals; the ovary and short style are the length of the stamens, and glabrous. The fruit, which I have not seen, is said to be 6–8 lines long and 4–5 lines in diameter*.

Var. *lata*;—foliis late ovatis vel obovatis, e basi 3–5-nerviis

* A figure of this plant, with analytical details, will be given in the 'Contributions,' vol. ii. Plate 67 A.

hinc obtusis, rotundatis aut subcordatis, apice breviter et acute mucronatis, margine cartilagineo sæpius obsolete dentato-spinosis, rigidulis, supra nitentibus et pallide viridibus, subtus opacis et flavescentibus, costa mediana superne paulo, subtus valde prominente, hinc in axillis nervorum poroso-glandulosis; petiolo brevi, lato, superne profunde canaliculato, in junioribus puberulo; racemis terminalibus, sæpe duplis, folio brevioribus, floribus dense agglomeratis, ramis brevissimis, puberulis, imo bracteatis, apice 2-floris; floribus sessilibus, ebracteatis.—*v. v.* ad Limache; *v. s.* in *herb. Mus. Par.*, Rancagua, in *herb. Hook.*, Valparaiso (Cuming, 556), Colchagua (Bridges).—An species distincta?

This variety is very distinct, in its constantly broader, larger, and more rounded leaves, the margin being often obsoletely spinose; the inflorescence is much shorter, and the flowers are more aggregated; the leaves are 2–2½ inches long, 1¼–1½ inch broad, on a petiole 1–2 lines long; the inflorescence is usually ¾ inch, seldom 2 inches long; the alternate branchlets, being less than a line in length, bear one or two flowers*.

2. *Villaresia pungens*, n. sp.;—ramulis teretibus, pallide glaucis, subpuberulis; foliis glaberrimis, obovatis, basi rotundis et subcordatis, apice acutis et aciculato-mucronatis, margine cartilagineo undulato-crispatis et crebre aciculato-spinosis, supra nitentibus læte viridibus, subtus pallidioribus, utrinque reticulatis, subtus nervis arcuatis costaque prominentibus, glandulis porosis nullis, aut raris in axillis nervorum; petiolo brevissimo, supra complanato, subtus convexo, et transversim ruguloso.—Concepcion, *v. s.* in *herb. Hook. et Mus. Brit.* (Cuming), *sine flore*.

This plant differs from the typical species in its larger leaves, which are nearly sessile, very broad and subcordate at base, less coriaceous, very shining, the margin being very crispately undulated, and armed at the distance of 1 or 2 lines with very sharp patent spines 1 line long; the poriferous glands are generally wanting, or, if present, are much smaller, and seldom in the axils of the nervures. The leaves are 2½–3½ inches long, 1½–2½ broad, on a petiole 1 line long and 1 line broad†.

3. *Villaresia Congonha*, nob.;—*Villaresia mucronata*, *Reiss.* (*non R. & P.*) in *Mart. Flor. Bras.* fasc. xxviii. p. 75, tab. 22 et tab. 14. fig. 18;—*Ilex Gongonha*, *Mart. Reiss.* (*edit. Angl.* ii. 100); *Lambert. Pin.* ii. *Append.* tab. 6; *G. Don. Dict.* ii. 18;—Cas-

* This variety, with analytical details, will be represented in the 'Contributions,' vol. ii. Plate 67 B.

† A representation of this plant will be given in the same work, Pl. 68.

sine Congonha, *Mart. Isis.* 1824, p. 589; *St. Hil. in Guillem. Arch. Bot.* i. 31; *Spreng. Syst.* i. 939;—Myginda Congonha, *DC. Prodr.* ii. 13; *G. Don, Dict.* ii. 16;—ramulis foliis oblongo-ovatis, imo acutis, apice obtusioribus et valde mucronatis, margine crassiusculo cartilagineo reflexo, rarius integro, sæpiissime breviter et remote sinuato-spinosis, coriaceis, utrinque subopacis, pallide viridibus, concoloribus, supra reticulatis, subtus costa, nervis tenuibus venisque paulo prominulis, et hinc vesicula immersa poro aperta in axillis omnibus nervorum donatis, petiolo subbrevis, canaliculato; racemis axillaribus et terminalibus, subspicatis, bracteatis, flavido-pilosis; ramis brevissimis, 3-floris, floribus parvisculis, sessilibus, bracteolatis, ramis basalibus iterum ramosis; sepalis parvis, rotundato-acutis, ciliatis; petalis oblongo-linearibus, subspathulatis, suberectis, cucullatis; staminibus brevissimis, sepalis vix longioribus; ovario glabro, ventre 2-sulcato.—Brasilia, in prov. australioribus et centralibus, *v. s. in herb. Hook.*; Rio Grande et Entre Rios (Tweedie).

This plant is considered by Dr. Reisseck to be identical with the typical species, of Chilian growth: it certainly resembles it in general appearance, but has several distinctly characteristic features. The leaves are differently shaped, and not so shining above; the racemes are usually axillary, and much shorter; the flowers only half the size; the petals are more linear, and the stamens proportionally shorter. In Tweedie's specimens, the leaves are $1\frac{3}{4}$ inch long, 1 inch broad, on a petiole $1\frac{1}{2}$ line long; in the drawing given in Lambert's work, of a plant from the province of Minas Geraës, which I have not seen, and which is probably a distinct species, the leaves are 4– $4\frac{1}{2}$ inches long, $2\frac{1}{2}$ inches broad, on a petiole 3–4 lines long. In both, the racemes do not exceed a length of 9 lines, and are often shorter; their lateral branchlets are 1–2 lines long, bearing on their summits a cluster of three to six extremely small sessile flowers; the sepals are $\frac{1}{4}$ the length of the petals, and are seated on a 5-lobed hispid torus; the petals are little more than $\frac{1}{2}$ line long, and $\frac{1}{8}$ line in breadth; they are erect (not expanded as in *V. mucronata*); in æstivation their summits are more deeply inflected: the stamens are $\frac{1}{2}$ the length of the petals; the ovary and style $\frac{3}{4}$ of their length. The ovary is glabrous, gibbous on the dorsal side, 2-sulcate on the ventral face, the style being somewhat excentrical, and with a clavate stigma*.

4. *Villaresia cuspidata*, n. sp.;—*Villaresia mucronata*, *Reiss. in parte* (non *R. & P.*);—ramulis angularibus, flavido-opacis,

* This species will be also shown in the same work, Plate 69.

foliis ovatis vel ellipticis, utrinque acutis, apicē mucrone longo valido cuspidatis aut retusis, crasso-coriaceis, margine cartilagineo integro crasso reflexo, supra nitidis, pallidiusculis, reticulato-venosis, nervis immersis leviter sulcatis, subtus valde flavido-opacis, minute nigro-punctulatis, costa, nervis arcuatis venisque prominentibus, rarius in axillis nervorum glandula porifera donatis, longe petiolatis; petiolo flavido-opaco, subruguloso, superne profunde canaliculato; racemis axillaribus et terminalibus 3-4, fasciculatis, folio tertia parte brevioribus, subspicatis; brachiis patentibus, imo bracteatis, summo flores 3 sessiles bracteolatos gerentibus; rachi brachiisque flavido puberulis.—Prov. Minas Geraës, *v. s. in herb. meo*; Salgado, ad Rio San Francisco.

This species differs from the preceding in having still thicker leaves, which are quite entire, nigro-punctulate beneath, and rarely with poriferous glands in the axils of the nerves; the petiole is three or four times the length of that of the former. The leaves are $2-2\frac{3}{4}$ inches long, $1\frac{1}{4}-2\frac{1}{4}$ inches broad, on a petiole 5 or 6 lines in length. The racemes are 9-12 lines long, the lateral branchlets 1 line long. The flowers are much smaller than in *V. mucronata*, being about $1\frac{1}{2}$ line in diameter when expanded; the minute sepals are nearly glabrous, membranous, with ciliate margins, concave, suborbicular, acute at the apex, and imbricated; they are adnate upon an externally pilose deeply 5-lobed fleshy torus: the petals are elliptic, with an internal carinated nervure, three times longer than the sepals; the stamens are two-thirds the length of the petals, and as long as the ovary and style, which are quite glabrous*.

5. *Villaresia megaphylla*, n. sp.;—ramis angulatis, striatis, opacis; foliis majusculis, oblongis, imo acutis, summum versus breviter attenuatis, acumine calloso, integerrimis, margine undulato, submembranaceis, glaberrimis, nervo marginali tenuissimo revoluta nitido, supra pallide viridibus, opacis; costa mediana immersa, hinc sulcata, inferne prominente et striata; nervis tenuissimis venisque haud reticulatis utrinque vix prominulis et eglandulosis, impunctatis; petiolo longiusculo, subtenui, semitereti, supra canaliculato, imo articulato; paniculis axillaribus et terminalibus, paulo supra basin brachia 5-8 arcute approximata et fere fasciculata emittentibus, divaricatis, folio dimidio vel triente brevioribus, spicatum racemosum; ramis remotiusculis, brevibus, patentibus, imo bracteatis, apice flores parvos, 3-5 sessiles bracteolatos gerentibus; sepalis parvis bracteolisque puberulis; petalis oblongis, glabris, et stamini-

* A drawing of this plant will be given in the 'Contributions,' vol. ii. Plate 70.

bus æquilongis; ovario dense albido-piloso, uniloculari; stylo subexcentrico, breviusculo, glabro.—Prov. Rio de Janciro, *v. v.* circa Freichal, ad pedem montium Organensium.

This and the following species are very dissimilar in appearance to any of the preceding, bearing somewhat a resemblance to the genus *Leretia*; but their floral structure is quite in accordance with *Villaresia*, and some have the same porous glands in the axils of the nervures that characterize the genus. The leaves are $7\frac{1}{2}$ inches long, $3\frac{1}{4}$ inches broad, on a petiole 10 lines long: the radiating divisions of the inflorescence, in my specimen, are 2 inches long; but as they are in a young state, they probably would be double that length when fully matured; the lateral branchlets are 1 line long, quite patent, and bear three or five sessile flowers at their apex: the flower expanded is $2\frac{1}{2}$ lines in diameter; the sepals are obovate, somewhat acute, imbricate, and pilose; the petals are lanceolate-oblong, nearly three times as long as the sepals, with a prominent internal keel; they are imbricated in æstivation, with their apices inflected: the stamens are three-fourths the length of the petals, and longer than the pistil: the ovary is obovate and pilose, 1-celled, with two suspended ovules*.

Var. *acuminata*;—foliis longius acuminatis, paniculæ brachiis folio fere æquilongis, ramis remotioribus et paulo longioribus, floribus majoribus, ovario interdum 2-loculari cum stylis 2.—*v. v.* in hort. bot. Kew. cult.

The differences above mentioned may only be the result of culture; but I think the plant must be referred to the species above described, which I found at Freichal. The leaves in this cultivated variety are $6\frac{1}{2}$ – $7\frac{1}{4}$ inches long, $2\frac{3}{4}$ –3 inches broad, on a petiole of 5 or 6 lines; the radiating branches of the inflorescence are 2–6 inches long, the main stems nearly glabrous; the lateral branchlets alternate, $\frac{1}{4}$ – $\frac{1}{2}$ inch apart, and quite patent, are 2–3 lines long, and pubescent: the flowers expanded are 3 lines in diameter.

6. *Villaresia virescens*, n. sp.;—glaberrima, ramulis teretibus, vix striatulis; foliis ellipticis vel oblongis, utrinque acutis, apice acuminatis, integerrimis, submembranaceis, margine cartilagineo nitido reflexo, obscure viridibus, opacis, subtus pallidioribus; nervis tenuibus venisque vix prominulis, eglandulosus et epunctatis, breviter petiolatis: paniculis racemoso-spicatis, simplicibus, axillaribus et terminalibus, breviusculis; floribus sessilibus in apice ramorum brevissimorum glome-

* This species, with analytical details, will be seen in the same work, Plate 71.

mulatis; sepalis pilosis; petalis glabris, intus carinatis; ovario glabro; stylo brevi, subexcentrico; stigmatе clavato, subbilobo.—Prov. Rio de Janeiro; *v. s. in herb. meo*, Iguassa, ad pedem montis Serra de Tingoá.

A species analogous to the last mentioned, with smaller leaves, acute at both extremities, with much shorter petioles. The leaves are $4\frac{1}{2}$ –5 inches long, $1\frac{3}{4}$ –2 inches broad, on a petiole 3 lines in length. The inflorescence consists of a short simple panicle, in which the lateral branches are so short and approximated that the whole bears the appearance of a spike of agglomerated flowers: the sessile flowers are nearly 2 lines in diameter; the sepals are oblong, membranaceous, obtuse, and slightly pubescent; the petals are 1 line in length and three times as long as the sepals, they are smooth, carinate within; the stamens are nearly equal to them in length, and as long as the pistil; the ovary is almost glabrous.

7. *Villaresia ramiflora*, n. sp.;—glaberrima, dichotome ramosa, ramulis striato-angulatis; foliis lanceolato-oblongis, vel ellipticis, imo cuneatis, apice longiuscule sensim acuminatis, acumine obtusiusculo calloso, integerrimis, margine cartilagineo rubello nitido revoluta, supra viridibus subopacis, costa nervisque immersis sulcatis, subtus ferrugineo-pallidis; costa striata, nervis tenuibus venisque subprominulis, cavitate porosa versus axillas nervorum, aliisque minutis vagis; petiolo subtenui profunde canaliculato: panicula ramosa, terminali, petiolo 3-plo longiore; floribus parvulis, sessilibus in ramis subglomerulato-spicatis; sepalis villosis; petalis ovatis, paulo acutis, intus carinatis, sepalis 2-plo longioribus; staminibus, sepalis pistilloque æquilongis; ovario glabro, vel pilis paucis in sulco ventrali munito; stylo brevi; stigmatе clavato.—In montibus Organensibus prov. Rio de Janeiro, *v. v.*

This species is near *V. megaphylla*, but has many distinct features. Its leaves are 4–5 inches long, $1\frac{3}{4}$ –2 inches broad, on a petiole 4–5 lines long. The panicle is little more than an inch long; it has several alternate branches, 4–6 lines long, the lateral branchlets being extremely short or almost obsolete, each bearing three sessile flowers in its apex, which make the branches appear glomerate-spicate; the flowers expanded are smaller than any of the preceding.

8. *Villaresia paniculata*, nob.;—*Leonia paniculata*, Mart. *hb. Bras.* No. 420; DC. *Prodr.* viii. 669 (*in adnot.*);—*Leretia paniculata*, Mart. *Flor. Bras.* fasc. xvii. p. 17 *in not.*;—foliis oblongis, basi attenuatis, apice obtusis vel acutis, coriaceis; nervis tertiariis vix distinctis; paniculis terminalibus, con-

tractis, folio brevioribus; drupa oblonga, 1-sperma.—In sylvis prov. Rio de Janeiro.

I have not seen this plant, which evidently is very closely allied to, if not identical with, one of the three last-named species. The size of the leaves is not given by DeCandolle, nor the characters of the flower; but its fruit and seed are completely those of *V. mucronata*. The calyx is said to be 5-partite, with puberulous ovate sepals; the drupe oblong and 1-seeded, the seed being plicated round the prominent longitudinal indurated placenta, which is enlarged by other two abortive cells, and projects far into the cavity of the fertile cell, the seed being suspended from its summit. The specimen, being fructiferous, appears to have had no flowers, as Prof. DeCandolle says of it, "flore ignoto."

XIV.—Contributions to an Insect Fauna of the Amazon Valley.

COLEOPTERA: LONGICORNES. By H. W. BATES, Esq.

[Continued from vol. viii. p. 478.]

Genus *ÆTHOMERUS*.

Thomson, Class. des Céramb. p. 338.

Syn. *Macronemus*, Dej. Cat.; White, Cat.

Char. emend. Body subcylindrical. Muzzle moderately broad, quadrate; front plane; antenniferous tubercles short, prominent, widely separated at their bases. Antennæ naked, excessively elongated, in some species being five or six times the length of the body, capilliform; the joints slightly increasing in length to the apex, the eleventh joint generally the longest; the basal joint short, very slender at the base, abruptly enlarged into an ovate club. Palpi normal. Prothorax unituberculated on the sides. Elytra rounded at the tip. Femora clavate; tarsal joints short. Prosternum greatly constricted between the large anterior coxæ.

The sexes are not distinguishable, as in Longicornes generally, by the relative length of the terminal antennal joint in most of the species; there is a sexual character, however, in the apical ventral segment, the ♀ having in that part a deeply impressed fovea. The genus was established on certain curious species which agreed in having greatly elongated and hair-like antennæ, and strongly bowed fore tibiæ. I have extended the definition so as to embrace the *Alplus Lacordairei* of Dejean's catalogue—an insect which differs from all other *Alphi*, including *A. tuberosus* of Germar, to which it has otherwise some resemblance, in the curiously abrupt dilatation of the first antennal

joint—a feature characteristic of the genus *Æthomerus*. *Æ. Lacordairei* differs from the other species in having straight fore tibiæ, and in having rather less elongated antennæ, whose articulations are much shorter in the ♀ than in the ♂.

The species are nocturnal in their habits. They are of rare occurrence, and are found in the daytime crouched on leaves,—*Æ. Lacordairei*, however, being seen only closely adhering to decayed boughs. In those species which have strongly bowed fore tibiæ, the anterior femora are greatly enlarged and furnished on the inner side with a sharp ridge, which fits a corresponding groove along the tibiæ. In the crouching position, the fore legs are closely folded, the almost invisible antennæ laid backwards, and the whole insect assumes a rigid aspect, well calculated to deceive its enemies. *Æ. Lacordairei*, on the other hand, possesses passive means of defence of quite a different character: its colours and markings give it a deceptive resemblance to a dead pupa covered with a fungous growth, such as is often seen adhering to trees in damp climates. The deception is perfect, the insect having on each side of its body a large spot coloured and reticulated like a wing seen through the integument of a pupa. Thus we see here another instance of the widely different means Nature employs, within the same genus, to maintain the existence of her specific forms. Every species exists by virtue of some endowment which enables it to triumph over the infinite diversity of adverse circumstances that surround it at all stages of its life. This concerns us here, inasmuch as the general principle has an important bearing upon the systematic arrangement of species, a knowledge of the fact that structures are adapted to the ends just mentioned being necessary to avoid errors in estimating their affinities. Longicornes are greatly subject to these adaptations, those parts of structure being modified, from species to species, on which we depend for the establishment of genera, thus rendering, in this family, real generic definitions almost impossible.

1. *Æthomerus antennator*, Fabricius.

Lamia antennator, Fab. Syst. Eleuth. ii. p. 288. 36.

Æ. elongatus, tenuiter tomentosus, niger vel brunneus, variegatus: elytris inæqualibus, lineis tenuibus argenteo-albis inscriptis, basi elevatis, apud medium subnudis nitidulis. Mas segmento ultimo ventrali simplici: fœmina eodem fovea magna impresso. Long. $3\frac{1}{2}$ – $4\frac{1}{2}$ lin. ♂ ♀.

Head dark brown. Antennæ pitchy brown, the apices of the joints paler. Thorax with two dorsal tubercles in a transverse line with the lateral ones, all four of equal size; the surface punctured; dark brown or blackish, varied with lighter brown.

Elytra with short but strongly elevated and crested centro-basal ridges, the space between the two being also elevated and clothed with a silky fulvous-brown pile; the sides in the middle have each a very large depression: the surface of the elytra is punctate-granulate in rows, one of which runs straight along the disk on each side, continuous with the centro-basal ridge; others are diverted out of their course by the lateral excavations, within which the surface is extremely irregular; the disk near the suture is irregularly punctured; towards the apex are some elevated lines; the disk is naked and shining: the colour is generally nearly black, in some specimens silky brown of various shades; there are also numerous very slender silvery-white lines, two of which, more conspicuous, oblique on the disk, form an inverted V. Body beneath and legs dark brown, covered with a slight pile, and varied with paler shades. Anterior femora dilated; tibiæ curved and grooved on the inner side. Antennæ capilliform. In the male the apical ventral segment is simple; in the female it has a large deep transverse fovea near the apex.

This species I met with at Pará, at Obydos in Brazilian Guiana, and at Santarem; it is found also at Cayenne. I have received it from M. Dupuiset, of Paris, as *M. ruficornis*, var. I think there can be no doubt it is the *Lamia antennator* of Fabricius; his description (somewhat better than the Fabrician descriptions usually are) seems to suit our insect sufficiently well. I have thought it better to give a more detailed description, for the sake of fixing the Fabrician name with more precision. The white lines are faint or wanting in some examples.

2. *Æthomerus rufescens*, n. sp.

Æ. elongatus, tomentosus, brunneo-ferrugineus: elytris inæqualibus, basi elevatis, omnino brunneo-tomentosis: antennis pedibusque ferrugineis. Mas segmento ultimo ventrali apice fortiter bisinuato; foemina latet. Long. 4 lin. ♂.

Head rufous brown. Thorax tuberculated as in *Æ. antennator*, clothed with rusty-brown pile, faintly punctured. Elytra with short but strongly elevated and crested centro-basal ridges, the space between them being slightly elevated; the sides in the middle have each a very large depression; the surface of the elytra along the discal portion is impunctate, being clothed with pile, and there is no line of granulations in continuation of the centro-basal ridge: the strongly flexuous line along the disk is present, the lateral ones are broken and confused within the excavation, as in *Æ. antennator*; the whole surface is rusty tomentose and opaque; there are indications of white lines in the same position as in the preceding species. Body beneath, legs, and antennæ ferruginous red. The apical ventral segment in the

male is strongly bisinuated at the tip. Anterior femora dilated; tibiæ curved and grooved within. Antennæ capilliform.

Taken at Santarem. The distinctness of this species from the foregoing depends more upon the structure of the ventral apical segment than on the general colour and clothing, which seem to be variable in these species.

3. *Æthomerus Lacordairei*, n. sp.

Æ. subcylindricus, cano-tomentosus, fronte, vertice et thoracis vitta dorsali violaceo-brunneis: elytris utrinque apud humeros macula magna lineata albam mentiente instructis, in medio prope basin fuscis, apices versus canis tuberosis. Long. $6\frac{1}{2}$ lin. ♂ ♀.

Head rather broader, and front more plane, than in the preceding species; epistome and cheeks hoary white, rest of the head dark brown; antennæ yellowish, partially clothed with fine hoary-white pile. Thorax somewhat rugose transversely; lateral tubercles acute, dorsal ones only slightly raised, hoary white, a broad stripe of a violet-brown colour down the centre. Elytra with the centro-basal ridges short, obtuse, punctate-granulate, chiefly in rows, but more confused in the middle towards the base; on each side near the shoulders is a large yellowish spot traversed by the rows of granulations, which are of a darker colour and varied by discoloured punctures in the interstices, the whole producing an imitation of a wing; the basal space between the two spots is blackish; the apical half of the elytra is hoary-white, tomentose, varied with dusky, and having white tubercles in rows continuous with the granulate punctures of the basal part. Body beneath and legs yellowish testaceous, clothed unevenly with hoary-white tomentum. Fore femora and tibiæ simple. The antennæ in the male are about three times, in the female about twice, the length of the body.

Taken at various places on the Lower and Upper Amazons, closely clinging to dead boughs. As I have before stated, this species is the *Alphus Lacordairei* of Dejean's Catalogue, according to French collections.

Genus MYOXINUS (Dej. Cat.), nov. gen.

Head narrow across the vertex, the antenniferous tubercles being very prominent and directed upwards. Antennæ simple, the basal joint pyriform-clavate, though somewhat slender, shorter than the third. Palpi with their terminal joints slender and pointed, as in *Lamiæ* generally. Thorax with the sides furnished with a short simple spine, without conical tubercle; the disk having three small acute tubercles. Elytra with short, strongly raised and abrupt, crested centro-basal ridges; their tips rounded. Mesosternum narrowed behind, but broader than

long, its front oblique and bituberculated. Prosternum simply rounded.

The narrowness of the head across the vertex, and the consequent approximation of the antenniferous tubercles, which at the same time are very prominent, amply distinguish this genus from *Acanthoderes*, as well as from the following, *Alphus*. It has, in common with *Alphus*, the comparative slenderness of the basal joint of the antennæ; but this is more pyriform and shorter in comparison with the third in *Myoxinus* than in *Alphus*. The form of the thorax and the crested ridges of the elytra contribute to give the species a peculiar facies. The name was first given, in Dejean's Catalogue, to an undescribed species; the genus has never been characterized; the species to which the generic name was applied I have seen in collections, and it appears different from the one I took; both belong, however, decidedly to the same genus. M. Thomson (Classif. des Cérambycides, p. 337) unites the genus to *Alphus*. It is more nearly allied to *Alphus* than to any other genus; but I think the characters given above will show that it should be separated from it.

Myoxinus pictus, Erichson.

Acanthoderes pictus, Erichs. Conspect. Ins. Peruan. p. 144.

I took this species at Ega and St. Paulo. It is sluggish in its motions, and is found on dead branches of trees, to the bark of which the insect is assimilated in colours. I have nothing to add to the excellent description given by Erichson in the place quoted.

Genus ALPHUS, Thomson.

Thomson, Classif. des Cérambyc. p. 10.

M. Thomson notices the shape of the basal joint of the antennæ, but, I think, not with sufficient detail to show the difference in that respect between this genus and its allies. In *Alphus* this joint is very gradually thickened, and is nearly equal in size to the third; therefore it is not pyriform in shape, as is the rule in the *Acanthoderitæ*. The genus differs from *Myoxinus* in the greater breadth of the head across the crown; the head, however, is much narrower than it is in *Acanthoderes* and the allied genera; the muzzle also is much more obtuse. The genus, in fact, forms a connecting link between the *Acanthoderitæ* and the *Acanthocinitæ*, the chief character of the latter group being the great length of the basal joint of the antennæ, which exceeds that of the third. The other characters of *Alphus* which require mention are the sockets of the fore haunches, which in most of the species are angulated exteriorly; the fore tarsi, which are not dilated in the male; and the mesosternum, which is much nar-

rowed behind, as in *Myoxinus*. As the genus is very imperfectly known at present, I add a list of all the described species, including those introduced in the present memoir.

1. *A. leuconotus*, Thoms. Classif. p. 10, = *sellatus*, Dej. Cat. sec. Chevrolat. South Brazil.
2. *A. pubicornis*, Serville. South Brazil.
Oreodera pubicornis, Serv. Ann. Soc. Ent. Fr. iv. p. 21.
Ægomorphus pubicornis, White, Cat. Long. Col. Brit. Mus.
3. *A. centrolineatus*, n. sp. Amazons and Venezuela.
4. *A. senilis*, n. sp. Amazons.
5. *A. scutellaris*, n. sp. Amazons.
6. *A. canescens* (Dej. Cat.?), n. sp.* South Brazil.
7. *A. tuberosus*, Germar.
Lamia tuberosa, Germ. Ins. Sp. nov. p. 477.

8. *A. subsellatus*, White.

Alphus subsellatus, White, Cat. Long. Col. Brit. Mus. p. 375.

The *Ædilis griseofasciata* of Serville, included by White in this genus, does not belong to it. Its proper position, as shown by the length of the basal joint of the antennæ and other characters, is amongst the *Acanthocinitæ*.

1. *Alphus centrolineatus*, n. sp.

A. oblongus, modice convexus, fusco-ferrugineus, tomentosus, pilis cervinis passim vestitus: thorace fusco bilineato: elytris punctatis, punctis setiferis, apice oblique truncatis, apud medium linea abbreviata, suturali, communi, fusca ornatis. Long. 5 lin. ♂ ♀.

Head moderately broad, tomentose. Antennæ in both sexes half as long again as the body, dull ferruginous, spotted with hoary tomentum, pubescent, more densely so beneath than above; the terminal joints more slender and less hairy than the preceding. Thorax with large lateral tubercles, and two impunctate obtuse dorsal ones, the interstices coarsely punctured: on each side of the upper surface is a longitudinal dark brown line. Elytra punctured throughout; the punctures closer and granulated towards the base, each furnished with a short blackish

* *Alphus canescens*, n. sp.—Oblongus, antice leviter attenuatus, tomento cinereo-olivascens vestitus. Caput parvum, fronte inter antennis concava. Antennæ corpore duplo longiores, infra dense ciliatæ, canescentes, articulorum apicibus nigris. Thorax grosse punctatus, supra breviter tricaratus. Elytra grosse irregulariter punctata, olivascens, apud medium canescentia, apicibus breviter truncatis, carinis centro-basalibus parum elevatis postice prolongatis. Subtus niger, pilis cinereis vestitus. Pedes cinereo-pubescentes. Long. 7 lin. Rio Janeiro.

bristle: the centro-basal ridges are scarcely indicated: the surface is dull ferruginous, tomentose, with a few streaks of hoary colour; in the middle of the suture is a short, abruptly limited, dark-brown line. Body beneath black, thinly clothed with hoary pile. Legs ferruginous, clothed with similar pile and also with long pale hairs.

The elytra in the male taper towards the apex, which is obliquely truncated, the outer angle being slightly produced; in the female, the elytra are of equal breadth, and are obtusely rounded towards the tips, which are simply truncated obliquely.

This species, which is nearly allied to *A. pubicornis*, Serv., of Rio Janeiro, I found at Obydos, in Brazilian Guiana, on decayed branches. I have a specimen, ♀, also from Venezuela.

2. *Alphus senilis*, n. sp.

A. oblongus, tomento cano-olivascens vestitus: thorace punctato, tuberculis lateralibus productis, dorsalibus tribus acutis: elytris granulato-punctatis, fasciculis pilorum ornatis, apice singulatim rotundatis, regione scutellari fusca. Long. 8 lin.

Head punctate, tomentose, slightly depressed between the antennæ. Antennæ half as long again as the body, ashy; the tips of the joints blackish. Thorax with very acute prolonged lateral tubercles, and three acute and prominent dorsal ones arranged in a triangle; the surface closely punctured. Elytra oblong, moderately convex, rounded at the tips; the centro-basal ridges prominent, crested with tubercles, the scutellar space between them very thickly impressed with large, regular, oblong punctures; this space is of a dusky or brown colour; the rest of the surface is olive-ashy, coarsely granulate-punctate; each elytron has three indistinct incomplete longitudinal ribs, and along each of these is an interrupted row of small fascicles of hair. Body beneath and legs clothed with hoary tomentum.

On dead branches, Obydos and Pará.

3. *Alphus scutellaris*, n. sp.

A. oblongus, tomentosus, cinereus, thorace brunneo, spatio triangulari apud scutellum violaceo-brunneo: thorace punctato, tuberculis lateralibus productis acutis, dorsalibus tribus obtusis: elytris granulato-punctatis, fasciculis parvis pilorum ornatis, apice singulatim rotundatis. Long. $4\frac{1}{2}$ lin.

Head punctured, tomentose. Antennæ half as long again as the body, ashy; tips of the joints blackish. Thorax with very acute-pointed lateral tubercles, two obtuse dorsal ones, and a third behind, smaller, also obtuse; the surface coarsely punctured, pubescent and brown in colour. Elytra with moderately raised crested centro-basal ridges, the scutellar space between them

densely and regularly punctured, violet-brown in colour; the rest of the surface is ashy-white, sparingly punctured; each clytron has two or three incomplete raised lines, along each of which is a row of very small linear pencils of dark-coloured hair. Body beneath and legs black, clothed with ashy pile.

This species I found at Caripí, near Pará. It is closely allied to the preceding, and is probably a variety of it; but its much smaller size, different coloration and punctuation, give it so distinct a character that, in the absence of connecting links, I am obliged to treat it as a separate species.

The present genus terminates the succession of generic forms which lead from the *Acanthoderes* type to that of *Acanthocinus* and *Leiopus*. I shall now return to a series of forms which appear to have branched off from *Acanthoderes*, especially from those species resembling *Pteridotelus* in general structure.

[To be continued.]

XV.—*On new Species of Snakes in the Collection of the British Museum.* By Dr. ALBERT GÜNTHER.

[Concluded from p. 59.]

NATRIX.

Physiognomy entirely that of *Tropidonotus*. Body stout, cylindrical; belly rounded; tail rather long. Temple shields of moderate size. Scales smooth, in 19 rows, without apical groove; anal entire, subcaudals two-rowed. Teeth of equal length, not grooved, of moderate length.

Natrix lavissima. Pl. IX. fig. 4.

We have employed for this new genus an old name well adapted for the snakes of the family of Natricidæ, but entirely abandoned by later herpetologists, and superseded by that of *Tropidonotus*. The present species has so completely the physiognomy of *Tropidonotus*, that we may be justified in giving a very short description. The anterior frontals are small, triangular, somewhat pointed anteriorly; two nasals, nostril between; a large loreal; one anterior and two posterior oculars; six rhombic temporals, the anterior in contact with the lower ocular only; eight upper labials, the eye over the fourth, the fifth slightly entering the orbit. Scales quite smooth, rhombic, in 19 rows. Ventrals 175; anal 1; subcaudals 76. Upper and lateral parts uniform blackish ash; ground-colour of the abdomen yellowish; a blackish band commences at the throat, and, gradually becoming broader and more irregular, covers nearly entirely the

ventral and subcaudal plates, leaving only their narrow outer edges yellowish. Length of the head 1 inch, of the trunk 24, of the tail 9.

This snake is probably from the East Indies.

Spilotes Salvini. Pl. IX. fig. 5.

Scales in 19 rows, slightly keeled; one anterior and two posterior oculars; eight upper labials, the fourth and fifth of which enter the orbit, the sixth very small, triangular, not quite so large as the fourth, the seventh the largest; one anterior and two posterior temporals, the anterior not much larger than, and in contact with, the oculars; the lower posterior temporal is in contact with the seventh and eighth labials, but not with the front temporal.

Head rather thick; neck and tail slender; body compressed. Rostral rounded, rather small; anterior frontals half as large as the posterior; vertical five-sided, with the posterior angle slightly obtuse, not twice as long as broad; occipitals obtusely rounded behind, as long as the vertical; the anterior ocular just reaching to the corner of the vertical; loreal square. Scales on the anterior part of the body much imbricate, in very oblique rows, those of the vertebral line of the anterior part of the body larger than the rest; each scale with two grooves at the apex. Ventral plates 215; anal entire; subcaudals 130. All the maxillary teeth of equal length. Ground-colour yellow, with broad black cross-bands, which are more regular and distinct from the ground-colour on the posterior half of the body than on the anterior, where they are more confluent, and many scales within the bands remain entirely or partly yellow. Each scale of the yellow interspaces has a black tip. Each shield of the head with black margins; occipitals black, with some symmetrical small yellow spots; suture of the eighth and seventh upper labials black. Lower parts yellow, many of the plates with black margins.

This species was discovered by O. Salvin, Esq., at Ezabal (Guatemala).

Zamenis gracilis.

Habit slender. Yellowish-olive, with a single series of large brown round spots edged with black, along the anterior half of the body; the spots become indistinct posteriorly, and only the black edges continue to form cross-bars on the back, being merely spots on the tail; head with two brown black-edged cross-bands, the anterior between the eyes, the posterior on the crown of the head, forming an acute angle on the vertical; the brown spot on the neck is produced forward within the limbs of the band across the crown; an irregular series of black spots on

each side of the belly, which is uniform yellow. Scales smooth; in 21 series. Upper labials 9, the fifth and sixth coming into the orbit; two anterior and two posterior oculars; occipitals rounded posteriorly, without larger scale behind.

Head rather narrow; body and tail elongate. Rostral shield moderate; the upper anterior ocular is in contact with the vertical; the lower is small, apparently a separate portion of the fourth upper labial; the sixth labial forms the lower third of the posterior margin of the orbit. Temporal shields small, scale-like, in four transverse series; the front series is composed of two shields which are in contact with the oculars. The posterior pair of chin-shields are separated from each other by intermediate scales. Two very indistinct grooves at the apex of the scales (invisible in numerous scales). Ventral shields 219; anal bifid; subcaudals 120. Length of head 7 lines, of trunk 17 inches, of tail 8 inches.

I have mentioned this species as var. B. of *Zamenis ventrimaculatus* (Colubr. Sn. p. 106), expressing my doubts as to its being distinct from it. Having found other specimens in the museum at Fort Pitt, said to have come from Western India (Kurrachee), I can no longer hesitate in considering them as a separate species. There are five specimens in the British Museum.

Psammophis taniata.

Allied to *Ps. sibilans*, but having only one anterior temporal in contact with the oculars. Anterior ocular not reaching to the vertical. Yellowish olive, with four green longitudinal bands edged with black; labial shields without any markings.

Specimens of this snake have been known to me for several years; but I hesitated to consider it as a distinct species until lately, when I had an opportunity of examining several others in the Fort Pitt Museum: they quite agree with those in the British Museum, and also come from India, very probably from the western parts.

Phragmitophis tricolor.

Herpetodryas tricolor, Schleg. = *Cyclophis tricolor*, Gthr., differs so much in its physiognomy from the other species of either of the genera to which it has been referred, that it will be better to establish for it a separate genus, for which I propose the name of *Phragmitophis*. The technical character by which it may be distinguished from *Cyclophis* is—loreal none, united with the posterior frontal.

Cyclophis, *Phragmitophis*, *Dryocalamus*, and *Hydrophobus* form a separate group in the family of Dryadidæ, which approaches the Calamaridæ and Coronellidæ, either by having some shields

of the head united, or by the body being moderately elongate, surrounded by not numerous series of scales. The last of the genera mentioned appears to be undescribed.

HYDROPHOBUS.

Head slightly depressed, broader than the neck; body and tail moderately slender, compressed, the ventral shields being angularly bent on the sides; loreal distinct, two anterior and two posterior oculars; one nasal, pierced by the nostril. Scales in thirteen rows, smooth, short, rounded, with a single groove at the apex. Teeth equal in length, smooth.

Hydrophobus semifasciatus. Pl. IX. fig. 6.

Shields of the upper surface of head regular; anterior frontals more than half the size of the posterior; vertical five-sided; occipitals rounded behind, much longer than vertical; rostral broader than high; loreal square, the upper ocular does not reach to the vertical. Seven upper labials, the third and fourth entering the orbit. Six small temporals, that on the side of the hind portion of the occipital being elongate, twice the size of the others; two are in contact with the oculars. Two pairs of chin-shields, the anterior being thrice the size of the posterior. The chin-shields are in contact with five pairs of lower labials. Back of the trunk broad, rounded. Ventral shields 232, anal bifid, subcaudals 84.

The ground-colour is pure white; back of trunk and tail crossed by fifty dark-brown bands, which are much broader than the interspaces between them, and do not extend downwards to the ventral shields. Upper part of the head brown to the posterior half of the occipital.

Length of head 3 lines, of trunk 75 lines, of tail 27 lines.

A single specimen (locality unknown) has been presented by T. C. Eyton, Esq.

Philodryas Reinhardtii.

Prof. Reinhardt (Vidensk. Medd. naturh. Foren. Kjöbenh. 1860, p. 224) refers *Philodryas viridissimus* to those snakes the scales of which are provided with two grooves at the apex, whilst Dr. Wucherer of Bahia describes those scales as one-grooved (Proc. Zool. Soc. 1861, Dec. 10.). I was induced by these contradictory statements to examine fifteen specimens of this snake, and found that those from Guiana had two-grooved scales and those from Brazil one-grooved. This led to a closer examination and search for other accompanying characters, whereby I was fully convinced that two species are confounded under the name *Ph. viridissimus*. The northern species (Pl. IX. fig. 8) has

the body much more compressed, and the ventral shields distinctly keeled; the scales on the middle of the trunk are rather short, rounded behind, two-grooved; the rostral shield is more depressed, considerably broader than high; six pairs of lower labial shields are in contact with the chin-shields. Ventral shields 228, subcaudals 128. This is the true *Philodryas* (*Coluber*) *viridissimus* of Linné, who states Surinam to be its native country, and 217 ventral and 122 subcaudal shields.

The southern species (Pl. IX. fig. 7) has the body more rounded, and no trace of a keel on the ventrals; the scales on the middle of the trunk are lanceolate, one-grooved; the rostral shield (in fact, the whole snout) is more elevated, as high as broad; five pairs of lower labial shields are in contact with the chin-shields. Ventral shields 191–196, subcaudals 108–110. All the five specimens of this species which I have examined are from Brazil (two from Bahia); and I name it after Prof. J. Reinhardt in acknowledgment of his having been the first who introduced this important character into science. Prof. Reinhardt enumerates the isolated instances in which the dots have been observed by herpetologists (p. 220); *Dendrophis punctulata* must be added to them, the grooves having been observed by Dr. Gray, who named this species after the “black dots” visible at the tip of each scale (King’s ‘Australia’ ii. App. p. 432). The grooves in this species are more distinct than in any other I have seen, being quite of a black colour.

Dromicus mentalis. Pl. IX. fig. 9.

Scales smooth, in nineteen rows, with two distinct grooves at the apex. Upper labials seven, the third and fourth entering the orbit; loreal square. Only five pairs of lower labials are in contact with the chin-shields. Five scale-like temporals.

Rostral shield oblique, much broader than high, just reaching the upper surface of the crown. Anterior frontals half the size of the posterior. Vertical oblong, with the lateral edges nearly parallel, much shorter than the occipitals, which are slightly rounded behind. The single anterior ocular extends to the upper surface of the crown; two posterior oculars. The anterior temporal shield, which is not much larger than the posterior ones, is in contact with the lower ocular, and very slightly with the upper. Ventral shields 189; anal bifid; subcaudals 112.

Ground-colour brownish olive; a black band from the eye running backwards and joining a black horseshoe-like band on the nape of the neck. A series of large black rhombic spots on the anterior part of the trunk, partly confluent into a zigzag band; they become less distinct posteriorly, the hind part of the trunk and the tail being nearly uniform blackish brown, with irregular

lighter spots. Lower parts of the head and each of the 50 anterior ventral shields with one, two, or three triangular black spots; the posterior ventrals and the subcaudals being uniform brown.

This is a West Indian Snake; but from what island, we cannot say. It is readily distinguished by the shields of the head. *D. antillensis* and *D. rufodorsatus* have six pairs of lower labials in contact with the chin-shields.

RHAMNOPHIS (Dendrophidæ).

Scales *smooth*, with a single groove at the apex, those of the vertebral and outer series very large, the others very narrow; ventral shields slightly keeled. Eyes very large. Posterior maxillary teeth very large and compressed.

Rhamnophis æthiopissa. Plate X.

Scales in 17 rows, those of the vertebral series elongate, irregularly six-sided. Head thick, snout as long as the eye; shields of the head regular; posterior frontals not much larger than the anterior; vertical large, broad anteriorly, tapering behind; occipitals rounded, not much longer than vertical. Nasal divided, loreal oblong; anterior ocular high, in contact with the vertical; two narrow posterior oculars; eight upper labials, the fourth and fifth entering the orbit; one large temporal, in contact with both oculars; two scales, larger than the others on the neck, behind the temporal; three pairs of chin-shields, the middle twice the size of the anterior, the hind pair divergent. Ventrals 175; anal bifid; subcaudals 152.

Bluish green, iridescent, each scale with a black margin; the green passes into yellow on the tail, and forms there narrow lines along the series of scales. Two blackish spots on the occiput, and a black line through the eye.

Length of head nine lines, of trunk 24 inches, of tail 12 inches. West Africa.

Diemansia cucullata.

Scales in thirteen rows; upper labials six, the third and fourth forming the lower edge of the orbit, the second labial in contact with the posterior frontal; rostral broad, low, very obtuse superiorly; shields of the head regular, all more or less rounded posteriorly and slightly imbricate; vertical twice as long as broad; one anterior and two posterior oculars; one temporal is in contact with the lower ocular, four or five scale-like temporals behind. 176 ventrals, 1 bifid anal, 47 subcaudals.

Brownish black, belly marbled with a lighter tint; the snout and the lateral parts of the head are greyish, punctulated with black;

the crown of the head is black, and is united with the back by a narrow band of the same colour, running along the median line of the neck; neck with an oblong light-greyish spot on each side of the band. Lower jaws brown, marbled with a lighter tint.

The single specimen sent by Mr. Krefft from the neighbourhood of Sydney is not in a good condition, half-dried, and apparently immature; it is nine inches long.

Diemansia torquata. Pl. IX. fig. 10.

Scales in fifteen rows, smooth. Brownish olive, each scale with a short white line at the basal portion of its outer margin; skin between the scales black; a brownish-black streak, edged with yellow, across the rostral shield and the loreal region, extending to the orbit. Posterior oculars yellow; a yellow streak edged with black from the eye to the angle of the mouth, continued into another similar band across the neck; another yellowish cross-band at some distance behind the former; the space between the two cross-bands dark brown, the whole forming a collar. Chin yellowish, marbled with grey; belly shining grey, a blackish band along the middle of the anterior half of the belly; tail reddish olive posteriorly.

Head flat; loreal replaced by the conjunction of four shields, as in the typical species; six upper labials, the third and fourth entering the orbit; two anterior temporals, the upper in contact with the lower postocular, the lower intercalated between the fifth and sixth labials. Scales without groove at the apex. Ventral plates 206; anal bifid; subcaudals 84.

Length of the head 7 lines, of the trunk 16 inches, of the tail 6 inches.

Habitat.—Percy Islands.

Hoplocephalus temporalis. Pl. IX. fig. 11.

Scales in nineteen rows; six upper labials, the second of which is pointed above, the third truncated; temporal shields small, numerous, in three series; two temporals are in contact with the post-orbitals, and a third below is intercalated between the two posterior labials.

Description.—Body stout, thick; tail rather short; head short and broad, distinct from neck; eye small, pupil subelliptical. Rostral shield triangular, nearly as high as broad, rounded above; anterior frontals small, broader than long, posterior frontals of moderate size, rounded posteriorly; vertical five-sided, much longer than broad, with parallel outer edges, and a pointed posterior angle; occipitals of moderate size; two posterior oculars, one anterior just reaching to the upper surface of the head; the postfrontal, nasal, ante-orbital and second upper labial meet at

a point and replace the loreal. Six upper labials; the first is lower than the following, the third and fourth enter the orbit. The chief character by which the species may be readily distinguished is the increased number of temporal shields, as stated above. Scales round the neck small. Chin-shields of nearly equal size; several scales between the hinder chin-shields and the first ventral; 129-132 ventrals, 1 anal, 35-37 subcaudals; a series of four teeth behind the grooved front tooth. Uniform olive-brown or chestnut-brown above, uniform yellowish below.

The five specimens in the British Museum are from South Australia (locality unknown); the longest (adult female) is 20 inches, the head being $\frac{3}{4}$ inch and the tail $2\frac{3}{4}$ inches long. It feeds on frogs.

Hoplocephalus nigrescens. Pl. IX. fig. 12.

Scales in fifteen rows; six upper labials, the second of which is pointed above, the third truncated. Uniform blackish olive above; ventral shields whitish, blackish on the sides; the entire head, superiorly and inferiorly, of the same colour as the back.

Description.—Body rather elongate, rounded; tail somewhat short, not distinct from trunk; head oblong, depressed, hardly distinct from neck; eye small, pupil subelliptical. Rostral shield very broad and low, and very obtuse superiorly; anterior frontals moderate, broader than long, rounded in front; posterior frontals rather large, five-sided, each with two hinder edges forming together a right angle; vertical six-sided, longer than broad, with parallel outer edges, an obtuse angle in front, and a pointed one behind; occipitals oblong, obtusely rounded behind; superciliary moderate; two posterior oculars, one anterior just reaching to the upper surface of the head; the postfrontal, nasal, anteorbital and second upper labial meet at a point and replace the loreal; six upper labials: the first is very low, situated below the nasal, the third and fourth enter the orbit; front series of temporals formed by two shields, one of which is in contact with the postorbitals. Chin-shields of nearly equal size, several scales between the hinder chin-shields and the first ventral, 173 ventrals, 1 anal, 37 subcaudals; the median line of the upper part of the tail is occupied by a series of large hexagonal scales; a series of small teeth behind the grooved front-tooth.

Length of the cleft of mouth 5 lines, of the tail 25 lines; total length $15\frac{1}{2}$ inches. This species was discovered by Mr. G. Krefft, in the environs of Sydney.

Callophis nigrescens.

Upper parts dark-blackish ash, lower uniform whitish; head with symmetrical black markings, one of which descends from

the occipital to the angle of the mouth (as in *C. trimaculatus*); a black horseshoe-like collar, with the convexity directed forward; a black line runs from the collar to the tip of the tail, along the vertebral series of scales; a series of roundish black spots, indistinctly edged with white, along each side of the anterior part of the trunk. Tail coloured like the body, without black rings. Upper labials seven.

Thirty inches long. Two specimens, from the Fort Pitt Collection, are in the British Museum. They are said to be from British India, locality unknown.

P.S.—*Elaeomorphus mexicanus* and *Hydrophobus semifusciatus* (Pl. IX. figs. 1 & 6) are represented twice their natural size.

Add to the first list *Tretanorhinus variabilis*, from Cuba, which has lately been received through the kindness of Prof. Peters. This raises the total number of species in the British Museum to 612, which are represented by more than 4100 specimens. According to a statement of Prof. A. Duméril (Arch. Mus. ix. 1857), the Paris Collection contains 523 species.

XVI.—*An Account of two remarkable Crustacea of the Order Cladocera.* By W. LILLJEBORG*.

[Plate VIII.]

THE two *Cladocera* which I am about to describe are of so remarkable a structure, that I have not thought myself justified in delaying their description, as I had previously intended, until I had an opportunity of issuing a continuation of my treatise on the *Cladocera*, *Ostracoda*, and *Copepoda*. Both are found in our fresh waters, and are widely disseminated. Baron G. C. Cederström, to whom, in this branch of knowledge, we are so greatly indebted, first drew my attention to the one species, and also transmitted to me specimens of the other. The former differs so widely from all *Cladocera* hitherto known as to form a separate family; but the latter belongs to the Polyphemidæ, although in some respects it strikingly deviates from the other members of that family.

That the former has not previously been noticed may be ascribed to the circumstance that it is so transparent as to be seen only with difficulty, although it is larger than any other *Cladocera*,—on which account it may well be contained in a glass of water without being seen, even with the aid of a lens. The other seems to be very rare, and probably has its abode in deep water.

* From 'Öfversigt af Kong. Vet. Akad. Förhandl.' Read May 16, 1860.

Leptodora hyalina*, nov. gen. et sp.

Corpus elongatum, teretiuseculum, testa vel cute tenuissima, hyalina, in segmenta 6-7 divisa obtectum. Caput longum, conico-obtusatum, rostro carens, supra postice gibbum et area ephippiiformi punctata præditum, et altius quam thorax positum, ita ut postice deorsum inflexum et sub angulo fere recto cum thorace conjunctum sit. Margo anterior thoracis, ubi pedes sunt adfixi, una cum margine inferiore capitis angulum fere rectum format. Ad marginem posteriorem et superiorem segmenti thoracici postremi apud specimina adulta feminina adest saccus magnus oviferus, vel "matrix," quæ exit ex apertura inter hoc segmentum et segmentum abdominale primum†. Abdomen longum, segmentis quinque, ramis caudalibus exceptis, compositum. Cauda postice divisa et ramos duos supra aculeatos gerens. Corpus totum valde hyalinum, et aqua vix obscurius est, qua de causa hoc animal ceteris *Cladocerus* pulchritudine excellit, eo magis quia oculus nitore insigni præstat.

Antennæ primi paris breves, ad apicem papilliferæ, in latere inferiore capitis prope oculum insitæ.

Antennæ secundi paris, sive remi, maximæ, trunco magnitudine insolita insigni, ramorum quadriarticulorum alter 28, alter 29 setas ciliatas gerens. Apud specimina juniora una vel altera seta deest.

Mandibulæ apicem versus attenuatæ, apice unguiformi et prope eum denticulis duobus et aculeo mobili præditæ. Maxillæ desunt.

Pedes elongati, prehensiles, ut maxillæ servientes minimeque branchiales, setis armati, et plerumque quadriarticulati; sex paria, quorum par primum longissimum. Secundum ad quartum par fere æqualia, anteriora tantummodo sequentibus paulo longiora. Quintum par antecedentibus multo brevius, et sextum par omnium brevissimum et tantum articulis duobus constans.

Labrum magnum et crassum, valde retractile et os obtegens. Labium ramis corneis corroboratum. Œsophagus tenuissimus et longissimus, ad extremitatem ventricularem claustrum cardiaco instructus, semperque motus peristalticos præbens. Ventriculus in extremitate posteriore corporis (in segmento antepenultimo et penultimo) situs, ab œsophago distinctus et quam hic multo crassior, parietibus sat crassis præditus, et fere ad anum sphincteribus constrictum porrectus.

Cor perspicuum, in parte dorsali thoracis situm, suturis et rimis, quarum posteriores sese perspicue pro sanguine aperientes, delineatum, et antice in vas sanguiferum productum.

Ovaria duo, in segmento primo et secundo vel etiam tertio abdominis sita, in cellulas septis pro ovis disjunctas dispartita. Ova in serie simplici, saltem interdum, posita sunt, et eorum latitudo 0.06 mill. Genus masculinum minime vidi, neque feminas pullos in matrice

* From λεπτός, tenuis, and δὸρά, pellis.

† In sacco ovifero ova tantummodo tria vidi.

portantes. Apud specimina juniora matricem minimam observavimus. Ova in matrice semper serie simplici posita fuerunt.

Oculus magnus, ex magno numero oculorum simplicium compositus, partem anteriorem capitis explens, pigmento fusco-nigro. Pone oculum videmus ganglia cephalica coalita, alterum pone alterum positum, anteriore naturam ganglii ophthalmici præbente. E parte posteriore exit nervus, qui postea in duos nervos, qui œsophagum ad latera circumdant, divisus est. Interdum hic nervus ab initio est divisus.

Motus saltatorius, non celeritate insignis. Victus ex animalculis constat. Pullos *Cyclopus* prehensos pedibus *Leptodoræ* vidi.

Longitudo corporis cum ramis caudalibus circ. 8 millim.

From the long cylindrical form of the body, the numerous natatory bristles on the second pair of antennæ, and more especially the long and narrow œsophagus, together with the distinct ventricles, situated in the hinder extremity of the body, and from the situation of the ovarium, *Leptodora* is distinguished from all other Cladocera. With the Polyphemidæ it agrees in not having the body covered with an arched shield, but differs in its long cylindrical form. This family appears, however, to come the nearest to it, on account of the absence of the arched shield, the form of the mandibles, and the absence of a branchial appendage to the legs; and, altogether, it would seem that the here-described *Bythotrephes*, Leydig, by reason of its long legs and long-extended abdomen, the most nearly resembles it. But the *Sida* or *Daphnella brachyura* resembles it most in the form of the head. I have not found in any Cladocer that the digestive canal bore any sign of transition to the form here described; but in the Rotatoria we sometimes find a similar long and narrow œsophagus, with a distinct stomach. The ovaria also bore some resemblance to those in the Rotatoria.

In younger individuals (Pl. VIII. fig. 2) the abdomen had only four segments besides the caudal branches, while in older ones there were five.

The *Leptodora* moves with a long horizontal spring, but is not remarkably quick. Its extraordinary transparency makes it, while living, a particularly interesting object for observation. The first time I took it, and placed the vessel in which it was kept in the sunshine, I was unable to see the animal itself, but its shadow only, when it moved.

Baron Cederström took it in a lake at Bolltorp, in East Gothland; also in the Ring Lake, in Scania. I have myself taken it in the last-mentioned place; also in the Mälär Lake, where it is pretty numerous. But it is only found in pure water, and at a long distance from the land.

Bythotrephes longimanus, Leydig.

Naturgeschichte der Daphniden, p. 244. figs. 73-75.

Corporis forma *Polyphemo* sat similis, abdomine vero magis evoluto et porrecto, ad apicem setam maximam et longissimam gerente, et pedum pari primo maximo. Caput omnino capiti *Polyphemi* simile, paulo deflexum. Organum adfigendi (Leuckart) deest. Matrix sive saccus oviferus maximus, supra thoracem situs, et antice vergens. Abdomen pone matricem porrectum et segmentis tribus compositum. Segmentum ultimum setam caudalem continuam maximam, corpore pluries longiorem gerit. Apud feminam adultam hæc seta duas dilatationes annulares testæ biaculeatas præbet. Infra basin hujus setæ est fissura analis, et ad fissuræ latera aculeus validus.

Antennæ primi paris minutæ, processui communi adfixæ et papillas tres vel quatuor portantes.

Antennæ secundi paris magnæ, birames, ramo uno tribus, et altero quatuor segmentis, quorum primo brevissimo, composito. Ramus trisegmentatus setis ciliatis septem, quarum segmentum primum et secundum unam, et tertium quinque setas gerit. Ramus quadri-segmentatus setis ciliatis octo, quarum segmentum secundum unam, tertium duas, et quartum quinque setas gerit.

Mandibulæ 0·045 mill. longæ, ad apicem inferiorem bipartitæ, parte una aculeis mobilibus vel setis, et altera parte dentibus vel processibus acuminatis tribus, quorum uno minimo, armata.

Maxillæ duæ, minutæ, lobuliformes, pone os et mandibulas positæ, antice vergentes, parte interiore crassiore et aculeis instructa, et parte exteriori apice setifero.

Pedum quatuor paria, omnia prehensilia, ad apicem setis aculeatis armata minimeque branchifera. Pedes primi paris maximi, et ceteris multo longiores, segmentis quatuor compositi, setisque majoribus apicalibus quatuor instructi. Hæ setæ ad marginem posteriorem aculeos mobiles portant. Testa segmenti basalis ad marginem inferiorem et exteriorem processum parvum emittit. Segmentum secundum intus processum acutum et postice setas sex vel septem, quarum duas ad apicem inferiorem, gerit, et segmentum tertium duabus setis posterioribus instructum est. Pedes secundi et tertii paris, qui etiam segmentis quatuor compositi sunt, ad latus interius segmenti secundi appendicem aculeis apicalibus instructam habent, et quatuor setas majores apicales portant. Pedes quarti paris brevissimi, tantum biarticulati, segmento ultimo setis pluribus, saltem 6 vel 7, quarum una in processu brevissimo posita, instructo.

Labrum magnum, processibus duobus, quorum posterior latior et magis obtusus et ad apicem setosus est. Tubus intestinalis simplex et simili modo atque apud *Polyphenum* formatus.

Cor magnum et fere quadrangulum.

Motus motui *Polyphemi* similis, sed ob setam magnam caudalem, quæ impedimento est, minus velox.

Longitudo corporis ad basin setæ caudalis circ. 1-1 $\frac{3}{4}$ millim.

With regard to its structure, *Bythotrephes* has the greatest affinity to the genera *Polyphemus*, *Podon*, and *Evadne*, and evidently belongs to the same group. From the first two, which it most nearly resembles, it differs in its more perfect abdomen and long caudal bristle. From *Evadne* it deviates even more widely.

It appears to be very rare. Baron Cederström took a few specimens in the lakes in Jemtland and in Wombs Lake, in Scania, which were communicated to me; and I have myself taken a solitary specimen in the Mälär Lake, near Flottsund. Of this I noticed that it remained at the bottom of the vessel in which it was contained, in consequence of the long caudal bristle being a hindrance to it in swimming. It is therefore probable that, in its free state, it abides less in proximity to the surface of the water than the *Polyphemus*, and that it is from this cause that it is so seldom obtained. F. Leydig found it in the stomach of *Coregonus Wartmanni*, taken in the Lake of Constance, in Switzerland. He did not succeed in procuring one alive, whence he supposes that it dwells near the bottom.

EXPLANATION OF PLATE VIII.

- Fig. 1.* *Leptodora hyalina*; a full-grown female, seen from above and somewhat from the side: *b*, the antennæ of the second pair; *k*, matrix.
- Fig. 2.* A younger female, seen from the side: *a*, an antenna of the first pair; *b*, base of an antenna of the second pair; *f*, gullet; *g*, stomach; *h*, heart; *i*, ovaria; *k*, matrix; *l*, head-ganglia.
- Fig. 3.* One antenna of the first pair.
- Fig. 4.* Both branches of one antenna of the second pair.
- Fig. 5.* One mandible seen under a glass cover.
- Fig. 6.* Upper lip lifted up (*d*), under lip (*e*), and both mandibles in their natural position.
- Fig. 7.* Ovarium.
- Fig. 8.* The front of the body, seen from above, to show the muscles passing to the second pair of antennæ: *a*, antennæ of the first pair; *f*, gullet; *h*, heart; *m*, the nerve-cord, passing from the back ganglion of the head, which behind separates and encompasses the gullet.
- Fig. 9.* *Bythotrephes longimanus*; a full-grown female: *a*, antennæ of the first pair; *b*, antenna of the second pair; *c*, a mandible; *d*, legs; *e*, upper lip; *k*, matrix.
- Fig. 10.* A younger specimen, 1 millim. long; sex unknown: *f*, heart.
- Fig. 11.* A leg of the third pair, seen from the inner side: *a*, with an appendage provided with prickles or points.

XVII.—*Note on the Ancient and Recent Natural History of Victoria.* By FREDERICK M'COY, Professor of Natural Science in the University of Melbourne, and Director of the National Museum of Victoria, &c.

To the Editors of the Annals of Natural History.

GENTLEMEN,

I drew up the following remarks as part of the preface to the local Catalogue of the collection of Victorian objects prepared for the International Exhibition to be held next year in London. As I believe, however, that some of the observations on the development of life in the geological periods may be interesting to geologists, as well as this first announcement of my identification of the various Canadian compound Graptolites in Victoria, and my recognition of *Zamites* and *Teniopteris* in our coal-beds, confirmatory of my view of their Mesozoic age, published more than a dozen years ago, in your Journal, I beg of you to do me the favour to permit me to occupy a little space once more in your pages.

I have the honour to remain, Gentlemen,

Your most obedient humble servant,

FREDERICK M'COY.

The most extraordinary character of the Recent Fauna of Australia is the appearance of isolation from the types inhabiting other parts of the world, produced by the great number of species belonging to genera not found in any other country, and by a large proportion of the species not only belonging to genera peculiar to the place, but by these generic groups being frequently separated from the genera of animals inhabiting similar latitudes, existing under similar circumstances, and performing the same vital functions elsewhere, by characters of such high ordinal importance as to indicate families, tribes, and even orders not found anywhere else, and sometimes even affording the only examples of strange departure from the general anatomical plan on which all other animals are formed. It is a point of the highest interest to ascertain by the aid of palæontology how far back in the earth's history this isolation dates from; and on this point I propose offering a few preliminary remarks, as the space allowed for the notice on the ancient and modern natural history of Victoria precludes the possibility of entering upon extended specific details.

Nearly all the great geological works draw attention to the fact that in the oolitic rocks of England bones and teeth are found, indicating the former existence there of marsupial animals of the same family as the common Bandicoot (*Perameles*) of

Australia generally, and of the *Myrmecobius* of South Australia particularly—such types of general structure of insectivorous Marsupialia existing nowhere now on the face of the earth except in Australia; and these fossil bones near Oxford are accompanied by myriads of marine shells of the genus *Trigonia*—a genus not now existing in any other than the Australian seas, where four species of it are not uncommon. Such facts are very commonly received as indicating a continuance to the present day in Australia of the fauna which disappeared in all the rest of the world with the close of the Mesozoic period; and this again carries with it the belief that Australia was the most ancient country in existence, having remained as dry land above the level of the sea for a period corresponding to that in which all the Mesozoic and Cainozoic formations of the rest of the world were being deposited. I am enabled to state that there is no sufficient foundation for this theory, from the great quantity of fossils which I have lately examined as Palæontologist to the Geological Survey of Victoria; and from evidence of this kind I can offer a sketch of the ancient successive changes of organic life in this country.

Palæozoic Period.

The Azoic rocks, I can now state, were succeeded in Victoria, exactly as in Wales, Sweden, North America, and other parts of the world in the northern hemisphere, by a series of rocks enclosing fossil remains of the well-known genera and even specific types of animal life characterizing those most ancient fossiliferous strata termed Lower Silurian by Sir R. Murchison, and Cambrian by Professor Sedgwick. In the slates, north of Melbourne, containing the auriferous quartz-veins of the gold-fields, I have recognized abundance of the double Graptolites for which I formerly proposed the genus *Diplograpsus*, so characteristic of strata of this age; and, what is curious, I have found of this genus no peculiar or new species, but, on the contrary, the identical forms so abundant in the northern hemisphere: thus the most abundant and widely distributed species in Victoria is the *Diplograpsus pristis*, perfectly identical with specimens occurring in the slates of Scotland, Wales, Ireland, Bohemia, Sweden, New York and Canada; the next most common is the *D. mucronatus* of Hall, so abundant in the Utica slates of New York, and which I also recognized in the slates in Ayrshire and Radnorshire; the *D. rectangularis* (M'Coy) is the next most common Victorian species, and perfectly undistinguishable from those I originally described from the slates of Dumfriesshire; the *D. ramosus* (Hall) described by the American palæontologist as from the "Utica slates," near Albany, but which I also detected in Scotland, is likewise represented by well-preserved specimens in the National

Museum from our strata, although a rarer species than the others. The forms called *D. folium* and *D. bicornis* in Europe also occur. Of the short leaf-shaped Graptolites allied to the *D. folium* of Hisinger and *D. ovatus* of Barrande from those ancient beds in Sweden and Bohemia, for which Professor Hall has recently founded the subgenus *Phyllograptus*, I can identify in the utmost profusion in several localities north of Melbourne his typical species *P. typus*, which he describes as so abundant in the similar slates of Canada, in the Decades of the Palæontology prepared by him to illustrate this portion of Sir W. Logan's 'Geological Survey of Canada;' and it occurs in Victoria in all the extremes of varied form which he describes it to assume in America; several of the specimens, I might add, prove clearly the fact of which he seemed to have some doubt when he first announced it, and which was generally rejected by European geologists—namely, the quadripartite arrangement of the cell-laminæ. Of the Twin Graptolites, for which I formerly proposed the genus *Didymograpsus* (also characteristic of strata below the Upper Silurian), we have in Victoria the *D. serratulus* (Hall) identical with that from the New York slates; the *D. caduceus* (Salter), identical with his Quebec examples, is very common; and the *D. furcatus* (Hall), identical with the New York "Utica slate" species, also occurs, though more rarely. Also we have that compound species, the *Graptolites gracilis* (Hall), exactly identical with the New York and Canada forms, and, more curious still, many of those extraordinary compound radiating forms, the *Graptolites Logani* (Hall), *G. quadribrachiatus*, and *G. octobrachiatus* (Hall), so recently discovered in abundance in Canada, and peculiar to that country, except for the present announcement of their occurring in Victoria, in the slates at Castlemaine. Of the simple, or doubtfully twin, Graptolites, I have also determined the *Graptolites Ludensis* (Murch.), *G. tenuis* (Portlock), *G. latus* (M'Coy), and *G. sagittarius* (Hisinger), occurring in various localities within a hundred miles north of Melbourne in abundance of well-preserved specimens identical in every respect with specimens of the same species occurring in the similar slates in Wales, Scotland, and Ireland. In Victoria, as in most of the European and American Graptolite localities, the slates containing abundance of these bodies frequently contain no organic remains of Mollusca; one of the exceptions to this rule occurs in the black Graptolite slate of Pen Cerrig, near Builth, in Radnorshire, where, with the Graptolites *D. mucronatus* and *D. pristis*, I discovered in 1851 an immense profusion of a small Brachiopod shell, which I published under the name of *Siphonotreta micula*. European geologists in general will, I have no doubt, be as much astonished as I was to recognize exactly the

same Graptolites, accompanied by the same little Brachiopod shell in the similar black slates of the "Deep Creek" section north of Melbourne. The characteristic genus *Hymenocaris* of these ancient beds in Wales also occurs here in a peculiar species, the *Hymenocaris Salteri* (M'Coy). In many other neighbouring localities I have recognized so many of the ordinary Bala and Snowdon fossils as to enable me to suggest the mapping of the Bala beds to the Geological Survey; and over them are clear representations of the Mayhill Sandstone: but, confining ourselves to the details now first made known of the contents of the Graptolite beds, we have the astonishing fact of the *specific identity of the marine fauna over the whole world* during the most ancient palæozoic period. This had already been recognized over an extended area in the northern hemisphere; but the extension with the present detail to the southern hemisphere cannot fail to give rise to the most interesting geological speculations. I now proceed to give the first distinct announcement, based on specific identifications, of the existence of the Upper Silurian formation in the southern hemisphere; and here, too, geologists will learn with interest the fact that at Broadhurst Creek, in Victoria, the rocks are filled exclusively with a profusion of specimens of the Wenlock Shale Trilobite, the *Phacops* (*Odontochile*) *longicaudatus*, so abundant at Cheney Longville in Shropshire and many Wenlock-Shale localities in Britain; and the cuttings in Johnston-street, in Melbourne, have afforded us the *Orthoceras bullatum*, so abundant a Ludlow-rock fossil in Wales. Here, again, we can point now for the first time to the marvellous fact of the specific identity of the inhabitants of the seas of the most widely distant points of the northern and southern hemispheres during this second great geological epoch of the zoological history of the earth.

2. Upper Palæozoic Period.

Professor Morris, Professor Dana, and myself have formerly pointed out a considerable but more general resemblance between the Upper Palæozoic rocks underlying the coal beds of New South Wales and Tasmania, and the lower part of the Carboniferous Limestone formation of the whole world (there having as yet been no distinct identifications to prove the existence in Australia of the intermediate Middle Palæozoic or Devonian formations). Here we have the extinction of the characteristic Trilobites, Graptolites, Corals, and Mollusca marking the Cambrian and Silurian epochs in Europe and North America, as well as in Victoria, at the close of those periods occurring in the southern hemisphere synchronously with this great change in the northern half of the world; and the new generic creations

marking the Upper Palæozoic period succeeding them similarly at this fourth great step in the creative changes of the earth in Australia as at the antipodes. Thus amongst the palæontologically important class the Crustacea, the genera *Phacops*, *Odontochile*, *Portlockia*, *Calymene*, and *Beyrichia*, which abound in the Lower Palæozoic rocks of Victoria, as in Wales, are replaced by *Phillipsia*, *Brachymetopus*, and *Bairdia*—Crustacean genera characteristically distinguishing the Carboniferous rocks in England and Russia from the earlier Lower Palæozoic beds; again, amongst the Brachiopodous Mollusca, numerous species of the genus *Producta* characteristically separate at a glance the Carboniferous formations of Europe and America from the Lower Palæozoic rocks; and exactly the same geological date marks the appearance of the same genus in the rocks of Victoria. Then, again, in the vegetable kingdom, the Carboniferous Upper Palæozoic period is strikingly distinguished from the Lower Palæozoic deposits by the various sections of the great genus *Lepidodendron* and its related forms. I rejoice to be able to announce that, in Victoria, this period is similarly marked by a large distinct species of one of the sections of *Lepidodendron*, which I identified in a block of sandstone collected (without other fossils) by Mr. M'Millan, from the Avon ranges in Gipps Land. This fossil is of the same species as the only *Palæozoic coal-plant* ever collected in New South Wales, where it was found by the lamented Leichhardt near the borders of Queensland, on the Manilla river, fully *two hundred miles north of the localities affording the plants associated with the coal of the Hunter, and other parts of New South Wales (which I believe to be Mesozoic)*, and by him given to the Rev. W. Clarke of Sydney, who sent it to me about twelve years ago for determination, during the controversy as to the age of the plant-beds of the Newcastle New South Wales beds, on which occasion I confidently pronounced, not only that it was a true Palæozoic coal-plant, but that it never came from the beds in dispute,—in which latter point I now find I was correct. To my friend Sir Charles Lyell, as well as to other geologists, I believe this identification of a true Palæozoic Carboniferous flora in Gipps Land will be of the highest interest, from the ingenious theory which they suggested to reconcile the difficulties arising from Prof. Morris and myself having indicated the strong connexion between the plant-beds associated with the coal of New South Wales and the Mesozoic coal-deposits of Europe, while we both agreed that the underlying marine beds were clearly Lower Carboniferous (Palæozoic), and the Rev. Mr. Clarke, the local authority, insisted that they were all of one age. The theory was this:—that possibly, owing to the immense geographical distance between Australia and the

typical sections of Europe, the plants growing on the land might have been those of the Oolitic period, while the sea contained the living inhabitants characteristic of the Palæozoic times. I combated this theory at the time by pointing to the similar Mesozoic coal-plants in Richmond, Virginia, at no great distance from the usual Palæozoic coal-flora of other American coal-fields, both remote from the typical European sections of the two coal-floras, but distinctly maintaining there their old-world peculiar forms. Nothing can, however, exceed the geological interest attaching to the distinct announcement I am now able to make of the land vegetation which first appeared, in the extreme remoteness of the Upper Palæozoic times, having been formed absolutely on the same type as that of the same period in the northern hemisphere; and here I am able to advance another step in the comparison between the ancient and modern natural history of Victoria and that of the antipodes, by showing that the wonderful identity in the marine fauna of the two hemispheres during the Palæozoic periods applied also to the productions of the dry land, which latter is also now shown to have emerged at the same period in Australia as the greater bulk of first dry land in Europe and America (the Devonian evidence being small exceptions to the otherwise first great appearance of dry land during the Carboniferous period)*.

3. *Mesozoic Period.*

The evidence of Mesozoic formations in Australia has been much disputed, resting until lately only on the characters of the fossil plants associated with the coal of New South Wales and Tasmania. This plant evidence is much more forcible now than ever, inasmuch as I have had opportunities of carefully investigating the fossil plants associated with coal seams in Victoria, at Cape Patterson and Bellerine, and for this colony I can now not only emphatically repeat the arguments which I used fourteen years ago, when writing on the plants associated with the coal of New South Wales† and Tasmania, namely, that all the genera and some of the species were closely allied to, or identical with, those of Mesozoic coal-beds, and that *all the characteristic Palæo-*

* It will be interesting to geologists to know that, up to a few months ago, Mr. Clarke had no stratigraphical evidence to bear out his view of the plant-beds being Palæozoic, or underlying the beds with marine Palæozoic fossils; and no such sectional evidence has been found by Mr. Schwyn, the Government geologist, in his careful surveys of the coal-bearing sections of Victoria and Tasmania; and the only section (Stony Creek, Maitland) now relied on by Mr. Clarke is, I think, clearly a deceptive appearance produced by a fault drawn on a section in which the vertical scale was enormously out of proportion to the horizontal one.

† Annals of Nat. Hist. ser. 1. vol. xx. pp. 145, 226, 298.

zoic coal genera, as *Calamites*, *Lepidodendron*, *Sigillaria*, *Stigmara*, &c., were completely absent, but I can add the very important fact that the *Pecopteris australis* (certainly identical with an Indian species from the Rajmahal beds), with the *Phyllothea* and other well-known plants of the beds associated with the coal in New South Wales and Tasmania and Victoria, are associated with numerous species of genera and even families of plants highly characteristic of the Mesozoic and more recent (as distinguished from the older) eras. Thus I have characterized four very distinct species of *Zamites* in the Bellerine beds, one only being rare (the *Z. ellipticus*, M'Coy, so called from its broad ovate leaflets), the three others being abundant: of these the most strongly marked is the *Zamites Barklyi*, which I have dedicated to His Excellency the Governor, in commemoration of the lively interest he has taken in the geology of the colony; and another the *Zamites longifolius* (M'Coy), I have also seen from the New South Wales beds. No *Cycadeous* plants are known anywhere in true Palæozoic coal-beds. I have also characterized a species of *Teniopteris* almost identical with the *T. vittata* of the Yorkshire (Scarborough) Oolitic coal-beds, and which I have described in a paper before the Royal Society of Victoria under the name *Teniopteris Daintreei*, after the gentleman who first collected it from the rocks associated with the coal of Cape Patterson; and it also occurs commonly in the two other Mesozoic coal localities near Melbourne, the Barrabool Hills and Bellerine. As the Baron de Zigno, in his recent writings on the Jurassic fossil flora, adopts my view instead of the Rev. Mr. Clarke's, as to the Mesozoic age of these Australian plant beds, because, as he says, the early statements of that gentleman, that the various characteristic Palæozoic genera *Lepidodendron*, *Sigillaria*, &c., occurred abundantly in them, had not been verified*, it will be of high interest to European geologists to learn that up to the moment at which I write no trace of them has ever been found in the beds containing the *Glossopteris*, *Phyllothea*, *Pecopteris australis*, the *Teniopteris*, or the *Zamites*, and that the only *Lepidodendron* or characteristic Palæozoic Carboniferous genus found was hundreds of miles from the beds containing the (as I believe) mesozoic plants, and not mixed with them. One argument used by the Rev. Mr. Clarke against the Mesozoic age of these plant-beds was the supposed absence of marine Mesozoic fossils in Australia; but even this argument (of no value, as I pointed out by a reference to Richmond, Virginia) has failed

* Not only have they not been verified, but I can confidently state now that any of the supposed recognitions of such genera only rested on misconceptions of portions of the ordinary mesozoic forms previously made known.

within the last few weeks: for a friend of Mr. Clarke's having collected a number of fossils from Wollumbilla, in the northern part of New South Wales, the latter gentleman sent them to Melbourne with a request that I "would determine the geological epoch to which they belonged;" and here, without at all entering on the description of the species, I can state that they furnish a most complete answer to the objection, and are the marine equivalents of exactly the same age as that I assign to the plant beds, *i. e.*, Lower Mesozoic, not older than the base of the Trias, and not younger, I think, than the lower part of the great Oolite. The collection contains large *Belemnites* of the general aspect of *B. giganteus*, *B. paxillosus* and similar Lias and Lower Oolite forms, *Pentacrinus*, and a number of large species of *Serpula*, *Lima*, *Pecten*, *Arca*, *Nucula*, *Rhynchonella*, &c., having the general facies of Lower Oolitic, Liassic, and Triassic forms*. And thus we reach the next great onward step in our attempt at a comparison of the natural history of Australia and other countries in the ancient periods, the history of whose creations can only be traced by palæontology; and we find that at this the Oolitic epoch to which allusion was made at the commencement of this paper, the whole facies of the fauna of the sea and the flora of the land had undergone just such changes as marked the geologically corresponding creations in India, Yorkshire, Germany, and America. I may remark that in the Wollumbilla fossils there are no *Trigonia*, although from the remarks in the first paragraph it is obvious that English geologists would expect them; but in their place I recognized a distinct species of Professor Bronn's muschelkalk genus *Myaphoria*, enabling me to suggest, on palæontological grounds, the presence of triassic beds in Australia.

4. *Tertiary Period.*

The next epoch in the Ancient Natural History of Australia, represented by the deposition of the widely spread Tertiary formations, could not have been contemplated by those who indulged in the speculations referred to in the beginning of this paper; for we find that here, as in Europe, the greater part of the country sank under the sea during the Tertiary period, and every trace of the previous creations of plants and animals was destroyed and replaced by a totally different new set, both of plants and animals, more nearly related to those now occupying the land and sea of the country. This, then, quite puts an end to the

* In a note received from Mr. Clarke since learning my impression of the age of these fossils, I am happy to state he announces his willingness now, as a new view, to consider his "Wianamatta beds," connected with the disputed Coal beds, as Lower Mesozoic.

speculations based on the supposition that Australia, unlike the rest of the world, had remained as dry land since the Oolitic period, and that the living little *Myrmecobius* and *Perameles* or *Bandicoots* were the associates of those little marsupials which lived at the time of the deposition of the Stonesfield or Collyweston slate of the Oolitic period in England. The fact really is, that in Victoria there is a rich Tertiary Dicotyledonous flora, totally unlike the Mesozoic one; and in Victoria, as in New Zealand, India, North and South America, and Europe, the races of animals now inhabiting the land were preceded in the most recent Tertiary or Pleistocene time by gigantic antitypes, as it were, characterized by the same anatomical peculiarities which mark the recent inhabitants of the place. Thus, as New Zealand had her little Kiwis or *Apteryx* preceded by an equally wingless but gigantic bird, the Moa or *Dinornis*, and South America had her existing peculiar little Sloths preceded by the colossal *Megatherium* and *Mylodon*, presenting the same peculiarities of anatomical conformation, so the Wombat and Kangaroo, the most peculiarly characteristic genera now inhabiting Australia, were preceded by the gigantic *Diprotodon* and *Nototherium*, in some measure uniting the osteological peculiarities of those genera; and their bones are found, like those of the extinct gigantic Irish Elk (*Megaceros*) of the same period, apparently bogged or mired in the mud of the ancient *Pleistocene* lakes. With these, at Lake Timboon and other localities in Victoria, true Kangaroos (*Macropus*) are found (*M. Titan*) of a size greatly exceeding the living ones. With these in some of the caverns, as at Mount Macedon, are found remains of recent species of *Hypsiprymnus*, *Hydromys*, and the carnivorous *Dasyuri* and the *Canis Dingo* or native dog, the recognition of which latter, I think, settles the point of its being truly an indigenous animal. I have likewise recognized the bones of the Wombat (*Phascalomys*) in the solid, hard, stony, ferruginous auriferous drift called "cement" by the gold-diggers, at a great depth in the sinkings at Dunolly, the material being so hard that the jaws could only be cleared by a stone-mason's chisel; this determination enables me to say that the age of the gold-drift of Victoria, like that of Russia, is, as Sir R. Murchison showed for the latter country, that of the "mammaliferous crag" of England.

The marine Tertiary fauna of Victoria is highly interesting in a natural-history point of view, from the extraordinary evidence it affords of the "law of representation, or representative forms," which it presents. Thus a series of beds about ten or twelve miles from Geelong, which I believe to be Lower Miocene, and a series of beds on the opposite shore of Hobson's Bay, between Mt. Eliza and Mt. Martha, which I believe to be Upper Eocene,

present the most extraordinary series of species of *Voluta*, representative of those of the Eocene clay of Barton cliff in Hampshire, and of the Miocene beds of the basins of Paris and Vienna, that can be conceived: the *V. spinosa*, *V. modesta*, and *V. suturalis* of the European Miocene beds are so exactly represented by species in the Geelong beds, that it requires a close examination to perceive the difference; and similarly the English and French series of Eocene species, *V. luctatrix*, *V. spinosa*, *V. lyra*, *V. ambigua*, and *V. digitalina* are "represented" in the most curious and exact manner by a similar series of species in the Victoria beds, having the same relations of form between themselves, and specifically almost undistinguishable at first sight from their northern analogues—the likeness being rendered stronger by the recognition of this complete parallel series in each hemisphere: and yet there is a minute difference (considered generic by some writers) separating the two series from each other,—the Eocene Tertiary Volutes of Europe having a regular sharp-pointed spire and forming the genus *Volutilites* of Swainson, while the Australian "analogues" have the distorted mammillated tip to the spire characteristic of the recent *Volutidæ*. Then, again, the common *Cassidaria depressa* of the Lower Miocene of Germany is so exactly represented by an equally common species in our beds of the same age, which I have named *Cassidaria reticulospira*, that the two can be distinguished only by the character indicated of a reticulation of the extreme whorls of the spire. The *Trivia avellana* of the same European beds is exactly replaced by the almost identical *Trivia avellanoïdes* (M'Coy) in the Victoria beds, and so on through a long series of representative forms, giving us the first distinct proof, in our progressive sketch of the development of life in Victoria, of the action of the "law of representation of specific centres" which plays so important a part in the distribution of organic life on our globe at the present day, but which, as we have seen, apparently had no effect in the more ancient times.

As bearing upon that question of great interest to the European geologist, the palæontological evidence of progressive changes of temperature in our earth, geologists will be interested to know that, as the living species in the European Miocene Tertiaries are generally inhabitants not of the neighbouring seas but of more southern warmer latitudes, so I observe exactly the same fact in Victoria, the recent shells mingled with the extinct ones in our Miocene deposits being usually forms not living in our bay or in the adjacent seas, but inhabitants of New Zealand (as the *Pectunculus laticostatus*, which is common in the fossil state with us, though not now living nearer than New Zealand) and the warmer latitudes of Adelaide and Northern Australia,—thus

showing here, as in Europe, the gradual cooling of our globe during the Eocene and Miocene periods. To refer again to the mistaken popular theory alluded to in the first paragraph, in which the suggestion is dwelt on of the present existence in the Australian seas of the possibly oolitic *Trigonia*, I think it of great interest to state that the four living species of *Trigonia* seem to have been created only during the modern period, and are represented in our Tertiary deposits by a totally distinct species—the *Trigonia semiundulata* (M'Coy).

5. Recent Period.

As the space assigned to me has been far exceeded, I can only offer a few remarks on the Existing or Recent Natural History of the country, which is so much better known than that which has preceded. The recent Mammalia and Birds of Australia are so fully known from the admirable works of my friend Mr. Gould, that I shall not allude at all to them, further than to correct an error which seems to be universal in books, and occurs even in the memoirs of Mr. Ronald Gunn, of Tasmania, namely, that the large *Dasyurus maculatus* is only found in Tasmania, and not on the Australian mainland. I have had seven or eight specimens collected for the National Museum from the Yarra Mountains and other hilly localities within thirty or forty miles from Melbourne. Contrary to my preconceived opinion, I have satisfied myself that the native Dog (*Canis Dingo*) is truly an indigenous animal, both from its increasing in numbers (with little variety) towards the interior of the continent remote from man, and from having identified its bones mingled with those of recent and extinct animals all in one state of preservation in the bone-caverns recently opened beneath the basalt flows at Mount Macedon.

Of Reptilia the great *Hydrosaurus varius*, called Iguana by the colonists, and often 5 feet in length, is the most important of the Lacertilia; several smaller types are also common near the coast, as the *Hinnulia taniolata*, *Cyclodus gigas*, and *Grammatophora muricata*; and the *G. barbata* and *Trachydosaurus rugosus* (called Dew-lizard by the colonists) become gradually common as you approach the warmer country near the northern boundary of the colony, but do not occur, I believe, south of the dividing range. Of Batrachia the *Ranhyla aurea* is the exceedingly common Green Frog of the country, and is so unlike *Hyla* in its habits, which agree completely with *Rana*, that its generic separation from *Hyla* (contrary to the opinion of several able authorities) is I think quite necessary. In two other Frogs, species of *Lymnodynastes*, the unexpected habit is found, in this arid, water-

less country, of habitually living buried to a considerable depth in the sandy ground during the day, coming up to feed by night, when in their turn they furnish food to the snakes on the dry plains. The Chelonian reptiles are not found nearer than the River Murray, where the only species known, *Chelodina longicollis* and *C. oblonga*, are those described by my friend Dr. J. E. Gray, of the British Museum, to whom our National Museum is so greatly indebted for the most valuable and friendly aid. The Snakes of the colony are rather numerous, and all, with one exception, poisonous; and that exception—the Carpet-Snake (*Morelia variegata*)—is only found in the warmer northern part of the colony. On the other hand, the venomous Snakes, properly so called, with isolated fangs, are scarcely found, the only example of Australian *Viperidæ* being the Death or Deaf Adder of colonists, the *Acanthophis antarctica* being extremely rare in Victoria, and only found in the warm districts near the northern boundary. The rest of the Snakes belong to the *Colubridæ*; and as the Snakes of Victoria have not yet been enumerated, I may just mention those I have ascertained. The *Hoplocephalus superbus* is a very abundant snake near Melbourne, and this poisonous snake is often unfortunately referred to erroneously under the name of “Diamond Snake” in accounts of experiments on the bites of poisonous Snakes and antidotes,—the true, harmless Diamond Snake (*Morelia spilotes*) of New South Wales not having as yet been observed in the colony of Victoria. The *Hoplocephalus curtus* is a still more abundant and venomous species around Melbourne, where it is usually called “Tiger Snake” from the brown transverse banding of most specimens; it differs remarkably from all the others of the genus in its power of dilating the sides of the neck, when irritated, into a broad, flat, leaf-like hood as in the Cobra. These two species become more rare towards the north, not having been observed in the warmer regions. *Hoplocephalus Gouldi* is extremely rare, I having only seen one Victorian specimen, it being here replaced by the only new species I have met with, namely, the *Hoplocephalus flagellum* (M'Coy), the common little “Whip Snake” of the colonists, having 19 and 17 rows of scales as constantly as its representative in W. Australia has 15. The beautiful little *H. coronoides* of Tasmania also occurs in Victoria, but is rare. Of *Diemansia* we have only one species, the *D. reticulata*, one of the commonest of the small snakes towards the Murray boundary of the colony, but not found in the cooler localities towards the southern coast. The beautiful “Black Snake” of the colonists (*Pseudechys porphyraicus*) is a formidable and very poisonous species, but has become very rare of late years in Victoria. The most dangerous of all the snakes of the colony, both from its size (usually about

five feet), its abundant distribution everywhere through the colony, and the fatal venom of its bite (frequently killing dogs and occasionally men), is the "Brown Snake" of the colonists—the *Pseudonaja nuchalis*, closely related to the *Naja* or Cobra of India. The statement published in Melbourne some years ago of the occurrence of a species of true *Boa* in Victoria only rested on a mistaken determination of the common Carpet-Snake (*Morrelia variegata*), in which the obvious characters which distinguish the Pythons of India, Africa, and Australia from the true Boas, confined to America, were overlooked.

In the class of Fishes many species remain yet to be determined. The more important species used as food are the "Schnapper" of colonists (*Pagrus unicolor*), abundant and often of great size, with large numbers of which the market is regularly supplied, and which is caught and dried in great quantities by the Chinese fishermen in Hobson's Bay, and supplied to their countrymen on the various gold-fields. The next most important species, from its being almost equally abundant at times in the market, and of equally large size and superior flavour, is the great Cod-perch, the "Murray-cod" of the colonists—the *Grystes Peeli* of Mitchell, or *Oligorus Macquariensis* of modern writers. A very much larger (occasionally five feet in length) and finer fish for the table, only an occasional visitor however, is the "King Fish" of colonists, which seems to me completely identical with the great "Maigre" of the Mediterranean—*Sciæna aquila*. Dr. Günther, the most recent European writer on ichthyology, in his General Catalogue of Acanthopterygian Fishes, states that the family *Sciænidae*, to which this fish belongs, has never been found in Australia. The fishes commonly called "Mullet" (*Dajanus Diemensis*) and "Whiting" (*Sillago punctata*) by the colonists are common in the fish-shops for the table, together with three species of "Flathead," *Platycephalus nematophthalmus*, *P. tasmanius*, and *P. lavigatus*, which are caught abundantly in the bay at all times. Another tolerably good table-fish is known to the colonists, and is found in the market under the name of "Pike," though, like all the other fishes bearing the names of English species, it has little resemblance and no affinity to the fish of that name in Europe: it is the *Sphyræna obtusata* and *S. Novæ Hollandiæ*. The so-called "Herring" of the fishermen is the *Centropristis Georgianus*, with which the market is also abundantly supplied. The "Baracoota," which visits us regularly, and is in some request for the table, is certainly the Cape of Good Hope *Thyrseles atun*. The small Ling, the *Lota breviuscula*, is occasionally procured for food on the coast, but is chiefly remarkable for the old full-grown fish (about a foot long) having, two or three years ago, been stated by some fishermen

to be the young of the great Newfoundland Cod : it was in vain that I pointed out the generic difference in the number of the fins, &c., and that these supposed young were adult ; the " practical men " carried conviction so far with them, that the merchants of the town subscribed some hundreds of pounds, twice, to fit out a vessel to commence a great cod-fishing, on a supposed cod-bank a few miles out, as a mercantile speculation. The Dory (*Zeus Faber*) is a rare visitant, but whether as delicious here as in Europe I cannot say, although a party of my scientific friends actually ate one of the three specimens I have known to occur during the seven years I have been in the colony, instead of sending it to the Museum. A Guard-fish (*Hemirhamphus*), a Tunny (*Thynnus*), and an Eel (*Muraena*) are also commonly used for food. Amongst useful fishes not good for food, I may mention the common European Sunfish (*Orthogoriscus Mola*) as not uncommonly caught in the Bay, for its large supply of oil.

Of Crustacea few kinds are used for food in Victoria : there are no true Lobsters and no Crabs (*Canceridæ*) fit for the table ; but a spiny Crayfish of about the same size and shape as the English species is very common at the Heads, and is supplied abundantly to the market : it is nearly identical with the *H. annulicornis*. The gigantic Murray River Crayfish (the *Astacoides serratus*) is now sent down alive in great numbers to the market for the table. The smaller River Crayfish (the *Astacoides quinquecarinatus*) is also often eaten in the country, but is not sent to market ; it forms the chief food of the so-called " Murray Cod," from the stomach of one of which I took twenty nearly perfect.

Melbourne University, 30th September, 1861.

XVIII.—*On some new Species of Cylichnidæ, Bullidæ, and Philinidæ, from the Seas of China and Japan.* By ARTHUR ADAMS, F.L.S. &c.

Genus CYLICHNA, Lovén.

1. *Cylichna japonica*, A. Adams.

C. testa cylindræca, rimato-umbilicata, epidermide fusca tenui sæpe oblecta, utrinque rotundata, apice perforato, transversim tota subtilissime striata, striis antice distantioribus ; apertura lineari, antice dilatata ; labio tenui, elongato, simplici ; labro margine vix recto, postice valde producto et rotundate angulato.

Hab. Korea Strait ; 46 fathoms.

Next to *C. arachis*, Quoy, which was likewise obtained in the

Korea Strait, this is the largest species of *Cylichna*; it differs from that species in being more elongated and less robust, and in the angle of the outer lip being produced and angulated, extending considerably beyond the apex.

2. *Cylichna proxima*, A. Adams.

C. testa ovato-cylindræa, utrinque rotundata, alba, solida, nitida, subopaca, transversim tota minutissime striata, apice profunde umbilicato; apertura lineari, in medio constricta, antice dilatata; labio plica crassa obliqua instructo; labro in medio recto, antice arcuato, postice subproducto rotundato.

Hab. Tsu-Sima; 26 fathoms.

Resembles *C. Sarsii*, Phil.; but the aperture is constricted in the middle; it is also like *C. concinna*, A. Adams, but is stouter and not produced anteriorly, and the angle of the outer lip is rounded.

3. *Cylichna venustula*, A. Adams.

C. testa ovato-cylindræa, utrinque subangustata, alba, solidula, nitida, transversim tota subtilissime striata, apice perforato; apertura lineari, antice dilatata; labio arcuato, plica obliqua instructo, antice vix truncato; labro margine regulariter arcuato.

Hab. Mino-Sima; 63 fathoms.

Has the form of *C. alba*, Brown, and the sculpture of *C. concinna*, but differs from the latter in being more robust, and in the inner lip being furnished with a distinct oblique plait.

4. *Cylichna rimata*, A. Adams.

C. testa ovato-cylindræa, rimato-umbilicata, alba, tenui, nitida, utrinque striata, apice perforato; apertura lineari, antice acuminata, producta, rima umbilicali lata; labio tenui, arcuato, simplici; labro postice producto, rotundato; margine rectiusculo.

Hab. Korea Strait; 46 fathoms.

Most like *C. umbilicata*, Mont.; but the last whorl is not acuminate posteriorly, the aperture is produced in front, and the inner lip is long and arcuated.

5. *Cylichna latiuscula*, A. Adams.

C. testa parva, ovato-cylindrica, antice acuminata, postice latiore, rimato-umbilicata, alba, tenui, lævi, nitida, apice profunde perforato; apertura angusta; labio tenui, simplici, arcuato; labro postice producto, late rotundato.

Hab. Tabu-Sima; 25 fathoms.

Most like *C. rimata*, A. Adams, but is shorter and much wider

posteriorly, and the angle of the outer lip is more rounded; it wants, moreover, the transverse striæ at each end.

6. *Cylichna lepidula*, A. Adams.

C. testa cylindracea, nivea, solida, nitida, polita, in medio vix angustata, postice truncata, apice vix perforato; periomphalo acuto; apertura lineari; labio calloso, plica valida, distincta; labro margine inflexo.

Hab. Tsu-Sima; 26 fathoms.

This species differs from all others described, in the periomphalus, or hind part of the body-whorl enclosing the sunken apex, forming an acute well-defined ridge. It is a small, white, highly polished, opaque shell.

7. *Cylichna consobrina*, A. Adams.

C. testa cylindraco-ovata, vix rimata, alba, solidula, longitudinaliter striata, utrinque striata, striis distantibus; apertura angusta; labio antice valde plicato; labro subarcuato.

Hab. Mino-Sima; 63 fathoms.

Most like *C. rimata*, but is more solid, longitudinally striated, and wants the conspicuous umbilical fissure of that species.

8. *Cylichna parallela*, A. Adams.

C. testa cylindracea, rimata, albida, solidiuscula, utrinque striata, longitudinaliter strigosa; anfractu ultimo lateribus parallelis; apertura lineari, antice producta; labio callo reflexo rimam tegente; labro margine recto, postice producto et angulato.

Hab. Tsu-Sima; 16 fathoms.

Most nearly resembles *C. involuta*, A. Adams; but the aperture is produced and pointed anteriorly, the sides of the body-whorl are nearly parallel, and the outer lip forms posteriorly a produced angle.

9. *Cylichna assimilis*, A. Adams.

C. testa cylindracea, sordide alba, solida, breviuscula, postice truncata, dilatata, antice acuminata, sub lente obsolete tota transversim striata; apertura lineari; labio incrassato, plica evanida; labro margine rectiusculo, postice subproducto et rotundato.

Hab. Mino-Sima; 63 fathoms.

A small species, somewhat resembling *C. involuta*, A. Adams, but much shorter, dilated behind, narrowed in front, and with the hind angle of the outer lip rounded.

10. *Cylichna pumila*, A. Adams.

C. testa parva, alba, tenui, ovato-cylindracea, in medio subconstricta, utrinque rotundata, longitudinaliter substriata; apertura latiuscula; labio tenui, arcuato, simplici; labro margine in medio inflexo.

Hab. Tsu-Sima; 16 fathoms.

A small, thin, elongate-oval species, somewhat contracted in the middle. It is very unlike any other hitherto described.

11. *Cylichna candidula*, A. Adams.

C. testa cylindracea, alba, transversim tota confertim striata, postice subtruncata, antice producta et subacuminata; apertura lineari; labio subincrassato, antice obsolete uniplicata; labro margine in medio rectiusculo, postice vix producto, rotundato.

Hab. Tsu-Sima; 26 fathoms.

This species partakes of the character of *C. venustula* and *concinna* with regard to sculpture and general appearance, but is elongated and cylindrical.

12. *Cylichna inedita*, A. Adams.

C. testa cylindracea, postice subtruncata, antice acuminata, alba, tenui, longitudinaliter strigosa; apertura lineari, antice producta; labio elongato, flexuoso; plica parietali conspicua; labro margine recto, postice subproducto, rotundato.

Hab. Mino-Sima; 63 fathoms.

A small, thin, strigose species, with the aperture anteriorly produced, and with an elongate subspiral fold at the fore part of the inner lip.

Genus TORNATINA, A. Adams.

In addition to the two species of this genus described below, I have obtained, by deep-water dredging, *T. voluta*, Quoy and Gaim.; *T. olivula*, A. Adams; *T. pusilla*, Pfeiff.; *T. simplex*, A. Adams; *T. planospira*, A. Adams; *T. fusiformis*, A. Adams; *T. gracilis*, A. Adams; and *T. truncata*, J. Adams; some of which have also occurred in the Yellow Sea.

1. *Tornatina delicatula*, A. Adams.

T. testa cylindraceo-ovata, alba, tenui, nitida, spira truncata, apice mammillato, longitudinaliter substriata; apertura lineari, antice

dilatata; labio plica obliqua conspicua; labro margine vix arcuato.

Hab. Mino-Sima; 63 fathoms.

In the obtuse subtruncate spire and papillary apex, this species resembles *T. pusilla*, Pfeiff.; but it is longer and more slender, and the aperture is more produced anteriorly.

2. *Tornatina succincta*, A. Adams.

T. testa cylindracea, in medio coarctata, vertice truncato, alba, longitudinaliter tota striata, transversim fasciata, fasciis pallidis subdistantibus; apertura lineari, in medio angustata, antice dilatata; labio obsolete plicato.

Hab. Tsu-Sima; 16 fathoms; Awa-Sima; low water.

In form this species most resembles *T. truncata*, J. Adams; but it is more elongated and much narrower, and marked with indistinct pale bands; the whorls of the spire are visible, but sunken, and the parietal plica is not conspicuous.

Genus VOLVULA, A. Adams.

The animal of this little genus, described by me in 1850, but which is not generally known to conchologists, has hitherto eluded our researches. The shells are only obtained by deep-water dredging, but, judging from their form, sculpture, colour, and texture, appear to belong to the family Cylichnidæ. During the voyage, I have obtained all the species hitherto described, including *V. mucronata*, Phil., and *V. angustata*, A. Adams, from the China Sea, and *V. striatula*, *eburnea*, and *rostrata*, A. Adams, from the Sea of Japan. *V. acuminata*, Brug., the type of the genus, is called an *Ovulum* by Hanley, and is an inhabitant of the British seas. I now give brief diagnoses of six new species.

1. *Volvula opalina*, A. Adams.

V. testa elongato-ovali, rimata, alba, semipellucida, lævi, nitida, antice obsolete transversim striata, mucrone brevi in angulo producto labri incluso; apertura angusta; labio tenui, obliquo, incurvato; labro regulariter arcuato.

Hab. Mino-Sima; 63 fathoms.

2. *Volvula spectabilis*, A. Adams.

V. testa elongato-ovali, postice acuminata, antice rotundata, mucrone brevi non producto, tenuicula, alba, nitida, minutissime transversim striata; apertura mediocri; labio tenui, elongato, vix flexuoso; labro regulariter arcuato.

Hab. Tabu-Sima; 25 fathoms.

3. *Volvula cylindrella*, A. Adams.

V. testa cylindraceo-ovata, utrinque obtusa, transversim tota striata, striis confertis, mucrone brevi acuto non producto; apertura lineari; labio subtortuoso; labro margine rectiusculo.

Hab. Mino-Sima; 63 fathoms.

4. *Volvula ovulina*, A. Adams.

V. testa elongato-ovali, subventricosa, transversim tota striata, umbilicata, antice gibbosula, mucrone parvo acuto in angulo producto labri incluso; apertura lata; labio tortuoso, elongato, antice late reflexo; labro regulariter arcuato.

Hab. Mino-Sima; 63 fathoms.

5. *Volvula radiola*, A. Adams.

V. testa subcylindracea, utrinque acuminata, mucrone producto, acuta, alba, opaca, transversim tota striata, striis distantibus; apertura lineari, antice dilatata; labio obliquo, recto, subincrassato; labro margine recto.

Hab. Tabu-Sima; 25 fathoms.

6. *Volvula attenuata*, A. Adams.

V. testa ovato-cylindracea, utrinque angustata, transversim tota striata, striis distantibus, mucrone acuto producto; apertura lineari, antice vix dilatata; labio subtortuoso, obliquo; labro margine subarcuato.

Hab. Tsu-Sima; 26 fathoms.

Genus HAMINEA, Leach.

Besides the three new species of this genus which I am about to describe, the following were also obtained from the Sea of Japan:—*H. rotundata*, A. Adams; *H. brevissima*, A. Adams; *H. pygmaea*, A. Adams; and *H. succinea*, Conrad.

1. *Haminea fulgida*, A. Adams.

H. testa elongato-cylindracea, alba, tenui, nitida, subpellucida, utrinque rotundata, transversim tota striolata, striolis minutissimis confertis; apertura angusta, antice dilatata; margine columellari acuto, arcuato; labro rectiusculo, postice producto et angulato.

Hab. Shan-tung (Kala-hai).

This is a beautiful white, shining, semipellucid species, most like *H. curta*, A. Adams, but more elongate and narrower, and engraved with very fine close-set transverse striolæ.

2. *Haminea lucida*, A. Adams.

H. testa cylindraceo-ovata, vix rimata, utrinque rotundata, diaphana, vitrea, transversim tota striata, striis minutissimis confertis; aper-

tura angusta, antice producta; margine columellari tenui, arcuato; labro postice rotundato.

Hab. Gulf of Lian-tung; Hulu-Shan Bay.

Like *H. brevissima* and *pygmæa*, A. Adams. An examination of the animal shows it to belong to *Haminea*, the genus which in all probability includes its above-named congeners. In my Monograph of the family (Sow. Thesaurus, *Bulla*), they are arranged under *Cylichnidæ*.

3. *Haminea strigosa*, A. Adams.

H. testa cylindraceo-ovata, utrinque rotundata, alba, nitida, sub-opaca, transversim tota minutissime striolata, longitudinaliter strigosa; apertura angusta, antice dilatata; margine columellari simplici, arcuato; labro recto, postice producto et rotundato.

Hab. Tabu-Simā; 25 fathoms.

White, with longitudinal slightly raised streaks, and entirely transversely striated. In form it resembles *H. lucida*, A. Adams; but the aperture is rounded anteriorly, and not produced as in that species.

Genus SCAPHANDER, Montfort.

Five species only of this limited genus have hitherto been described from Europe and America; and I now add brief diagnoses of six Asiatic species found by myself in the Sea of Japan. The shells, except to a person well acquainted with the family, might be mistaken for species of *Philine*, but are known by their distinct though sunken spire. They are also, being external shells, stronger and more distinctly sculptured; whereas the species of *Philine* are thin, more simple, and contained within the mantle of the animal.

1. *Scaphander japonicus*, A. Adams.

S. testa ovata, elongata, postice angustata, sordide alba, transversim sulcata, sulcis subconfertis punctulatis; spira occulta; apertura postice coarctata, antice dilatata; labio tenui; labro postice producto et obtusim angulato, antice rotundato; margine regulariter arcuato.

Hab. Mino-Simā; 63 fathoms.

The punctate striæ are common to most of the species of this genus. The present species nearly resembles *S. lignarius* in form, but is much smaller (only half an inch long); it is also less ventricose, and the transverse grooves are punctulate.

2. *Scaphander Cumingii*, A. Adams.

S. testa oblongo-ovata, postice constricta, albida, transversim oblique

sulcata, sulcis confertis punctulatis; apertura ampla, postice valde coarctata, antice dilatata et vix effusa; labio elongato, externe subreflexo; labro postice producto et acute angulato; margine postice inflexo, antice crenulato.

Hab. Mino-Sima; 63 fathoms.

Differs from *S. japonicus*, which it equals in size, in the last whorl being posteriorly constricted, in the close-set oblique grooves, in the narrowness of the last whorl, and in the acute hind angle of the outer lip.

3. *Scaphander elongatus*, A. Adams.

S. testa tenui, alba, elongato-ovata, utrinque angustata, transversim sulcata, sulcis distantibus, punctatis; apertura antice producta et dilatata, postice coarctata; labio tenui; labro margine regulariter arcuato.

Hab. Mino-Sima; 63 fathoms.

This species is elongate and narrowed at both ends, and the punctate grooves are wide apart. The spire of this and of all the other species is "truncata umbilicata," or "occulta."

4. *Scaphander sulcatus*, A. Adams.

S. testa elongato-ovata, solidiuscula, postice angustata, fulvescente, nitida, transversim sulcata, sulcis simplicibus, distantibus; apertura postice coarctata, antice dilatata; labio simplici; labro margine regulariter arcuato.

Hab. Korea Strait; 46 fathoms.

This is a small, smooth, rather solid species, transversely sulcate; the grooves fine, simple, and more strongly marked at the posterior extremity.

5. *Scaphander Sieboldii*, A. Adams.

S. testa parva, oblonga, alba, subtenui, postice coarctata, in medio gibbosa, transversim sulcata, sulcis distantibus, punctatis; apertura ampla, antice valde dilatata, postice angusta; labio postice reflexo, antice tenui arcuato; labro margine vix recto, postice producto et valde angulato.

Hab. Tsu-Sima; 26 fathoms.

The only species at all resembling this is *S. pectinatus*, from which, however, it differs greatly; it is very loosely convolute, and the last whorl is gibbose in the middle.

6. *Scaphander dilatatus*, A. Adams.

S. testa ovata, postice angustata, laxe convoluta, alba, tenui, transversim striata, striis crebris, simplicibus; spira parva; apertura ampla, postice angusta, antice valde dilatata; labio tenui; labro

marginē regulariter arcuato, postice producto et acute angulato.

Hab. Tsu-Sima; 26 fathoms.

This is a slightly convolute, thin, oblong species, with the transverse lines waved but not punctate, and the aperture greatly dilated.

Genus *ATYS*, Montfort.

This genus is one of the many good ones established by Denys de Montfort, who also gave us *Scaphander*, *Trophon*, *Phos*, and *Typhis*, and who did his best to illustrate his work by engravings of his own, which are certainly rude and not always accurate. For the better understanding of the genus, I have thrown my Japanese and Chinese species into subordinate but, I think, convenient groups.

Subgenus *ATYS*, Montfort.

Testa ventricosa, transversim striata.

1. *Atys amphorella*, A. Adams.

A. testa ovoidea, ventricosa, in medio gibbosula, rimata, tenui, lævi, nitida, luteola, antice angusta, postice subacuminata; labio subrecto, antice vix truncato; labro arcuato, postice producto, tortuoso, rotundato.

Hab. Lo-shan-kow; Shan-tung.

Atys tortuosa, A. Adams, is the nearest approach to this species, which, however, is not striated, and the outer lip has not the spiral twist so conspicuous in that species. My Chinese species is shaped like a little fat *Amphora*.

2. *Atys scrobiculata*, A. Adams.

A. testa ovoidea, ventricosa, postice angustata, antice acuminata, sordide alba, late et profunde umbilicata; umbilici marginē angulato; apertura utrinque valde producta; marginē columellari recto, simplici, antice rotundato.

Hab. Tabu-Sima; 25 fathoms.

The only shell which resembles this singular little species is *A. tortuosa*, A. Adams; but the great peculiarity of the aperture, which is pointed at both ends and produced beyond the body-whorl, distinguishes it from all others.

Subgenus *ROXANIA*, Leach.

Testa solida, ovoidea, transversim lineato-punctata.

3. *Roxania punctulata*, A. Adams.

R. testa ovoidea, solida, perforata, utrinque rotundata, decussatim

striata, transversim profunde sulcata, sulcis valde punctatis; apertura angusta, antice dilatata; labio recto, antice truncato; labro postice producto, rotundato.

Hab. Mino-Sima; 63 fathoms.

No species hitherto described resembles this: the nearest approach to it is *R. Cranchii*, Leach. *R. insculpta*, Totten, is sculptured rather like it. The shell is solid, very strongly punctate-striate, and deeply umbilicated; and the inner lip is truncate anteriorly.

Subgenus ALICULA, Ehrenberg.

Testa subcylindracea, transversim striata.

4. *Alicula translucens*, A. Adams.

A. testa cylindraceo-ovata, tenui, pellucida, utrinque transversim striata, striis distantibus, arca intermedia glabra; apertura angusta; labio recto, antice truncato; labro margine in medio rectiusculo, postice tortuoso et producto, antice crenulato.

Hab. Port Hamilton; 10 fathoms (mud).

This species most nearly resembles *Alicula succisa*, Ehrenberg, from the Red Sea, but is narrower and more cylindrical in form, and is thin and nearly transparent.

5. *Alicula secalina*, A. Adams.

A. testa cylindraceo-ovata, rimata, apice subtruncato vix perforato, cornea semiopaca, transversim tota striata, striis distantibus in medio obsoletis; apertura lineari; labio obliquo, subincrassato; labro in medio rectiusculo.

Hab. Tsu-Sima; 25 fathoms.

This is a small, grain-like, horn-coloured species, with the apex small and truncate, and the outer lip hardly produced beyond it.

6. *Alicula volvulina*, A. Adams.

A. testa cylindraceo-ovata, rimata, utrinque acuminata et transversim striata, striis distantibus, alba, tenui, opaca, nitida; apertura angusta; labio obliquo flexuoso, antice incrassato; labro regulariter arcuato.

Hab. Tsu-Sima; 26 fathoms.

A little white shining species, acuminate at both ends, like a *Volvula*, but with the sunken spire and twisted outer lip of an *Atys*.

Subgenus SAO, H. & A. Adams.

Testa pyramidata aut pyriformis, postice attenuata, antice gibbosa.

7. *Sao folliculus*, A. Adams.

S. testa obovata, umbilicata, solidula, basi dilatata, gibbosa, lævi, postice transversim striata, apice profunde perforato; apertura antice dilatata, postice angusta; labio incrassato; labro postice valde producto et acuminate angulato.

Hab. Tabu-Sima; 25 fathoms.

The only species resembling this is *S. pyriformis*, A. Adams, from the China Sea; but that species is much more ventricose, and more attenuated posteriorly.

8. *Sao phiala*, A. Adams.

S. testa cylindrico-pyramidali, antice attenuata, infra periomphalum subconstricta, rimata, utrinque transversim striata; vertice profunde perforato; apertura lineari, postice coarctata, antice dilatata; labio recto, elongato, simplici; labro postice valde producto.

Hab. Mino-Sima; 63 fathoms.

The peculiar contraction at the anterior part of the body-whorl just below the apex, the produced angle of the outer lip, and the straight simple inner lip are the chief peculiarities of this species.

9. *Sao elliptica*, A. Adams.

S. testa parvula, alba, tenui, elongato-ovata, antice subdilatata, longitudinaliter strigosa, utrinque transversim striata; apertura lineari, antice dilatata; labio recto, in medio calloso; labro margine arcuato, postice producto, rotundato.

Hab. Tsu-Sima; 16 fathoms.

A small, white, longitudinally strigose, ovate species, differing in form and appearance from any other of the group.

Genus PHILINE, Ascanius.

1. *Philine scalpta*, A. Adams.

P. testa oblongo-ovata, alba, tenui, semipellucida, longitudinaliter subplicata, plicis irregularibus, lineis transversis exaratis undulatis distantibus insculpta; apertura ampla; margine columellari tenui, acuto; labro regulariter arcuato, postice rotundato.

Hab. Tsu-Sima; 30 fathoms: Korea Strait; 46 fathoms.

Bulla exarata, Ph., or *Haminea sinensis*, A. Adams, is the only species resembling this in sculpture; but the form is very different: the body-whorl in that species is large, and the outer lip narrowed posteriorly and greatly produced.

2. *Philine crenata*, A. Adams.

P. testa ovata, alba, solidiuscula, postice subangulata, transversim

valde sulcata, sulcis transversim excavato-punctatis, eorum marginibus crenatis; apertura dilatata; margine columellari antice oblique truncata; labro semicirculari, postice parum producto et rotundato.

Hab. Tsu-Sima; 30 fathoms: Korea Strait; 46 fathoms.

No species has been described resembling this, which is nearly as large as *P. Coreanica*. The edges of the transverse grooves are conspicuously crenate, and the puncta or pits are transversely oblong.

3. *Philine acutangula*, A. Adams.

P. testa subquadrato-ovata, alba, tenui, postice subtruncata, transversim sulcata, sulcis excavato-punctatis; anfractu ultimo lateribus subparallelis; apertura aperta; labro margine semicirculari, angulo ejus postice incurvato, producto et acuto.

Hab. Gulf of Lian-tung; Hulu-Shan Bay.

The nearest approach to this species is *Ph. scutulum*, Lovén; but the produced sharp hind angle of the outer lip will serve readily to distinguish it.

4. *Philine striolata*, A. Adams.

P. testa parva, ovata, alba, tenui; semipellucida, postice rotundata, longitudinaliter plicata, transversim striolata, striolis confertis, subtilissimis; apertura dilatata; margine columellari arcuato; labro regulariter semicirculari, postice producto, rotundato.

Hab. Tsu-Sima; 30 fathoms.

In form this little species most nearly approaches *Bullæa pruinosa*, Clark, from the British Seas; but in sculpture it is entirely different, being very finely transversely striated.

Shanghai, China,
May 15, 1861.

BIBLIOGRAPHICAL NOTICES.

Forest Creatures. By CHARLES BONER, Author of 'Chamois-Hunting in the Mountains of Bavaria,' &c., &c. Small 8vo. London: Longman, 1861.

THAT an intimate connexion should exist between the chase and the study of natural history is not surprising. From the time when the conqueror of Arbela bade the Nimrods and Gordon-Cummings of his generation bring their hunting trophies and experiences to the Stagyrte sage, this connexion seems to have lasted down to our own day, which has seen the works of Mr. A. E. Knox and the late Mr. Charles St. John—men whom one hardly knows whether to regard as scientific sportsmen or sporting men of science. To such a class

belongs the author of the modest little octavo whose title stands at the head of this article. If Mr. Boner has failed to express himself so happily as the writers we have just named, and to invest the subjects and scenes he describes with the absorbing interest that pervades their works, it is for reasons of which, as critics from a zoological point of view, we need not complain, but prefer leaving his occasional faults of style to our more exclusively literary brethren. The author says in his preface, that he wishes it "to be understood that the book is wholly without scientific pretension;" but we must remark that its scientific merits are no less present because they are unassumed.

The animals treated of in 'Forest Creatures' are seven in number, namely, the Wild Boar, Roe, Red and Fallow Deer, Capercally (we prefer the spelling of the old Scottish law-books to our author's "Capercailie," or to the more common, more inconvenient, and equally un-English "Capercailzie"), Black Grouse, and Golden Eagle. There is also a chapter headed "Homer a Sportsman," which might be read with pleasure even by Mr. Gladstone; and another of "Hints," which might be read with profit even by Mr. Grantley Berkeley.

In England we are apt to imagine that none but our own countrymen have any right to be regarded as sportsmen. Our vanity has been flattered by amusing sketches and descriptions of fully-armed Frenchmen engaged in the pursuit of skylarks, or of a band of German students discharging a volley at a covey of partridges, from which, on the consequent fall of a single victim, the whole body of jägers would forthwith burst into a joyous hunting-song, to the astonishment of the British spectator. Mr. Boner's book may help to correct these grossly exaggerated notions, and serve to show that there is as much true sportsman-like feeling in Germany as in England. Indeed, it may be shortly said that sporting is peculiar to no age and to no nation.

But we must limit our remarks in this direction, and apply ourselves more especially to the zoological points of interest in the work we are noticing. Mr. Boner's account of the Wild Boar is especially deserving of attention; for in no modern English works are the peculiar habits of that "knightly beast" described. Quite recently also, doubts, apparently well founded, have been expressed as to whether or not our domestic swine have descended from the wild *Sus scrofa**, which even now has an extensive range throughout Europe, though there is, we believe, no record of its existence in England since the time of the first Plantagenet king, some seven hundred years ago. The Boar seems to be somewhat of a favourite with our author; and a well-executed representation of its head—no inappropriate device at this season of the year—glows on the green cover of his work.

We beg leave to draw the attention of physiologists to what is recorded of the Roe-deer by Mr. Boner. He announces, as "a new wonder in natural history," a discovery which he says has been

* See Mr. Bartlett's "Remarks on the Japanese Masked Pig," reprinted in our last volume (pp. 501, 502) from the 'Proceedings of the Zoological Society' for 1861, pp. 263, 264.

made by Professor Bischoff, of Munich, respecting the conception and gestation of that species. It is stated that—

“The rutting-season of the Roe is at the end of July and in August, this being the only time when the organs of the male and female are in such a state as to make procreation possible.

“In a few days, at most, after the rutting, the egg progresses in the usual way through certain channels—a process unnecessary to describe here,—and then arrives in the uterus; and here, *without undergoing any change whatever*, it lies dormant $4\frac{1}{2}$ months.

“In this undeveloped state it had always been overlooked by naturalists; moreover, as the uterus remains also quite unchanged, the belief that the doe was not pregnant seems to be confirmed.

“As will be remarked, all the circumstances were such as to mislead the investigator, and to incline to false conclusions.

“But in the middle of December the germ, which had been lying so long inactive, suddenly quickens, and, with the same fast progress as is observable in other Mammalia, develops so considerably, that in from twenty-one to twenty-five days all the parts of the egg and all the organs of the embryo are so formed as to undergo no further change before birth, except an increase in size.

“The different gradations in the development of the embryo, the various appearances which present themselves in the more or less advanced stages of growth, have been omitted as quite unnecessary, and, to many a reader, wholly unintelligible. These, however, have all been circumstantially noted down, and drawn with the strictest accuracy; and, moreover, the delicate germ and its infinitesimal tendril-like offshoots have been preserved, so that their progress towards maturity may be followed day by day and week by week, and the eye of the uninitiated, even, behold and comprehend what once Science alone could see.

“And for such discovery, and clear display of it, we are indebted to Dr. Louis William Bischoff, at this moment Professor at the University of Munich*” (pp. 44–46).

Now the extraordinary circumstance above related is not entirely new to English naturalists, though it may be so to many of our readers, for no comprehensive work on British Mammals has been published since those of Prof. Bell and Prof. MacGillivray, which appeared, the one simultaneously with, the other but shortly after Prof. Pockel's paper in Müller's ‘Archiv’ for 1836, wherein attention was first directed to the subject. Yet, if we are not mistaken, the discovery of the distinguished Bavarian physiologist has been noticed in some of our scientific journals; and we believe that the proof of his theory is considered satisfactory. However, we look forward to Prof. Bell telling us all about it in the new edition of his ‘British Mammalia,’ which is understood to be in preparation.

Two chapters are devoted to the Red-deer; and a subject which

* “In case any of my readers should be desirous of studying the subject with more scientific accuracy than it is possible to do from this sketch, the title of Prof. Bischoff's treatise is subjoined: ‘Entwicklungsgeschichte des Rehes.’ Giesson, 1854.”

has not, that we are aware of, hitherto received much attention from naturalists is very fully treated. This is the fact that the 'slot' or footprint of the animal reveals to the practised eye a faithful indication of its age, sex, size, and condition. Of course all this is well known to every good forester, but we are ignorant of any work in which the particulars are recorded; and here numerous illustrations are introduced, serving to explain the differences which may be observed. The Fallow-deer comes next in the book, but this theme is less dwelt upon; and then a few pages are occupied by the Capercally and Black Grouse, without any new facts in their history being, we believe, alleged, though Mr. Boner graphically describes the scenery of their haunts, and the methods employed of shooting the cocks of both these fine birds in the season of courtship—undoubtedly an unsportsmanlike practice, according to English notions, but one which, from their polygamous habits, may be indulged in without fear of too much diminishing the stock, and which, from the great extent of the German forests, added to the desultory wanderings of the birds at other periods of the year, is almost rendered necessary.

We cannot afford space to dwell on the Eagle-nesting exploits of Count Arco, who seems to possess the combined powers of MM. Blondin and Leotard, so great is his skill in balancing and leaping. An account of this gentleman's great feat at Rohrmoos has already been published in the English newspapers*. We can only regret that the custom of Eagle-destroying, which has even now deprived the Highlands of Scotland of so much of the ornithological interest they formerly possessed—and this without any great advantage to the sportsman—has been extended to South Germany. If Eagles' nests were always placed in the dizzy situation represented in Mr. Boner's frontispiece, we might rest assured that, in the absence of an enemy endowed with Count Arco's perseverance and gymnastic accomplishments, they would be pretty safe; but we fear the selection of such almost impregnable fortresses is rather the exception than the rule.

The illustrations to 'Forest Creatures' are well designed by the artist; but, we are sorry to say, the wood-cutter has done his best to spoil the spirit shown by the draughtsman, by his extremely clumsy execution. Should this little book, as it certainly deserves, attain the honours of a second edition, the publishers will do well to have the figures re-engraved.

Some naturalists there may be who will say that works like this of Mr. Boner's are of no scientific use, but are merely fit to amuse fox-hunting gentlemen during a frost, or shooting squires in showery weather. With such opinions we decidedly disagree, and recommend to their notice a little anecdote related in pages 219, 220 (whether it is true or not does not in the least signify), which the author introduces by the remark, "A trifle, if it be seen by one, even the most uncultivated, who understands the technical peculiarity, and knows what inference is to be drawn from it, may throw sudden light

* Vide 'The Field' for June 8, 1861.

on a subject, and clear up that which was before shrouded in mystery." Herein lies the explanation of the utility of all field-observations.

Report on the Geological Survey of the State of Iowa. By JAMES HALL (State-Geologist) and J. D. WHITNEY (Chemist and Mineralogist). Vol. I. Part 1. Geology; Part 2. Palæontology. Iowa, 1858.

In 1812 was published (in the 'Journal de Physique' for February) the first geological map of the United States of America, by William Maclure; and this was improved and republished at Philadelphia in 1817. Other independent observers, among whom were A. Eaton, L. Vanuxem, S. G. Morton, I. Lea, G. W. Featherstonhaugh, and W. Darby, continued to advance the knowledge of the geology and palæontology of the United States until about 1835, when considerable impetus was given to geological research by two circumstances:—firstly, Murchison's elucidation and arrangement of the Silurian strata, and the consequent clear systematization of the Palæozoic rocks in Europe and America; and secondly, the institution of special geological surveys by the Governments of several of the States of the North American Union and by the Federal Government itself,—the national importance of geological maps and reports having been recognized by the United States and by the English Governments at about the same time.

The geological surveys of the following States were commenced about this period:—Maine (C. T. Jackson), New Hampshire (C. T. Jackson), Vermont (Z. Thompson and C. B. Adams), Massachusetts (E. Hitchcock), Rhode Island (C. T. Jackson), Connecticut (C. U. Shepard and J. G. Percival), New York (W. W. Mather, E. Emmons, L. Vanuxem, J. Hall, J. E. Dekay, L. C. Beck, and T. A. Conrad), New Jersey (H. D. Rogers), Pennsylvania (H. D. Rogers), Delaware (J. C. Booth), Maryland (J. T. Ducatel), Virginia (W. B. Rogers), Ohio (W. W. Mather), Tennessee (G. Troost), Indiana (D. D. Owen), and Michigan (D. Houghton). Most of these State-surveys have been prosecuted with vigour by the geologists above named and others, and have been productive of good maps and memoirs, and of valuable collections and descriptions of fossils and minerals. Subsequently the State of Kentucky was preliminarily examined by L. P. Yandell and B. F. Shumard in 1846, and geologically surveyed by D. D. Owen in 1854–55; and Missouri has been reported on by G. C. Swallow. The States of Wisconsin, Minnesota, Iowa, and Illinois were geologically explored by D. D. Owen in 1839–52; Wisconsin by the late J. G. Percival in 1854; and Iowa was more specially surveyed by James Hall and J. D. Whitney in 1855–57, and the results of their labours are published in the Report before us. Previous to making any remarks on this work, we may mention that in the Southern States geological surveys have been established, —in North Carolina (D. Olmsted and E. Emmons), South Carolina (M. Tuomey and O. M. Lieber), Alabama (M. Tuomey), Georgia

(G. White), and Mississippi (B. L. Wailes); that Arkansas has been reported on by the late eminent geologist, D. D. Owen (1857-60); Texas is under examination by B. F. Shumard, and Illinois by A. H. Worthen; and that the geological constitution of the Western Territories of the United States has been learnt chiefly by means of the various expeditions, exploring, surveying, and military, undertaken since 1840.

Few of the State-surveys, except those of New York and Pennsylvania, rival in their results that of Iowa, whether we look to the elucidation of the geology of the country in letterpress, sections, and map, to the description and figuring of the characteristic fossils, or to the style and preparation of the books themselves.

We have, however, only the first portion of the Report before us; and that is divided into two large volumes,—one devoted to the descriptive geology, and the other to the palæontology, chiefly of the eastern counties of the State of Iowa. Messrs. Hall and Whitney were assisted by Messrs. A. H. Worthen, B. J. Hall, E. Hungerford, and E. A. Cooley in their geological explorations. They describe the country as being composed of nearly horizontal strata, of Palæozoic age, often covered by heavy drift-deposits of clay, sand, and gravel. The strata have a N.W.—S.E. strike, and dip gently, with undulations, to the N.E. The lowest rock is the Potsdam Sandstone (500 feet seen), exposed in the valley of the Upper Mississippi and its branches, especially the Upper Iowa River: above this follow the Calcareous Sandstone, or Lower Magnesian Limestone of D. D. Owen (200 feet thick); the St. Peter's Sandstone of D. D. Owen (80 feet); Trenton Limestone (100 feet), including the Black-river and Birds-eye Limestones; Galena-limestone (250 feet); Hudson-river Shales and Limestones (100 feet); [the Medina sandstone and Clinton rocks seem to be wanting;] Niagara Limestone (150 feet); Leclaire Limestone (more than 500 feet); Onondaga-salt Limestones, &c. (180 feet); Helderberg (Upper) Limestones (more than 50 feet); Hamilton Shales and Shaly Limestones (60 feet); Chemung Shales and Sandstones (80 feet); Carboniferous Limestones—Burlington Limestone (encrinital); Keokuk Limestone and Chert (Archimedal); Warsaw Limestone (Archimedal); St. Louis Limestone (concretionary); [the Ferruginous Sandstone of Missouri and the Kaskasia Limestone of Illinois are wanting;] lastly, the Coal-measures.

The lowest of these rocks occur only in the northern part of the State; the Coal-measures occupy the central and southern portions; and the whole series can be seen in section along the Mississippi by traversing the entire length of the State.

The geological formations of Iowa are those which are found to the eastward in New York and Pennsylvania; but, with one or two exceptions (especially the Potsdam Sandstone), they gradually become thinner towards the west. Thus the Cambro-Silurian rocks, from the Potsdam Sandstone to the Niagara Limestone inclusive, which are from 8000 to 10,000 feet thick on the borders of New England, or along the Appalachian chain, have a thickness of only about 1380 feet in Iowa.

The Coal-measures of the State are geologically continuous with those of Illinois and Wisconsin. They are unconformable to the older Palæozoic rocks, and overlap the edges of the slightly inclined strata of Devonian and Silurian age. As yet, in Iowa the Coal-measures have been proved to the depth of 500 feet only; whilst in Missouri they are 640 feet thick, in the Mississippi Valley 1000 feet, in Pennsylvania upwards of 6000 feet (and, including the Conglomerate, nearly 8000 feet), in Cape Breton more than 10,000 feet, and in Nova Scotia upwards of 14,000 feet. Only one or two seams of coal (from 3 to 5 feet or more thick) and a cannel-coal are worked in Eastern Iowa.

In Western Iowa the Permian formation is said to be represented by gypsiferous rocks; and the Lower Cretaceous rocks are well-developed both there and in the neighbouring Territories of Kansas and Nebraska. Mr. Hall, from the evidences already collected in the West, is inclined to believe in the existence of an extensive development of Jurassic rocks along the eastern side of the Rocky Mountains.

"It would appear," observes the author, "that, from the earliest Silurian times, the Great West, or the region of the Rocky Mountains, has been an ocean which successively received the finer sediments derived from eastern lands, or which produced within its own area the calcareous deposits,—but ever an ocean, not only to the close of the Carboniferous period, but still later through the Permian, Jurassic, and Cretaceous periods; showing apparently no evidences of dry land till about the beginning of the Cretaceous era, or perhaps a little earlier; while, in later Tertiary periods, the continental fauna and flora have been remarkably developed over the same area. Thus, while the older Palæozoic formations have been largely accumulated in the East, in successive beds, having altogether a thickness of several times the height of our highest mountains (in Iowa), they have greatly diminished in the West. At the same time, while the post-palæozoic formations are very thin or often absent in the East, they have accumulated in vast amount along the line of the Rocky Mountains, from one end of the continent to the other." (p. 141).

The physical geography of the country is described by J. D. Whitney, in chapter 1; the general geology, by J. Hall, in chapters 2 and 3; the geology of the Des Moines Valley, by A. H. Worthen, in chap. 4; the geology of certain counties, by A. H. Worthen and J. D. Whitney, in chaps. 5 and 6; and the chemistry and economic geology by J. D. Whitney, in chap. 7. It is stated that "the geological structure of the State clearly indicates that her agricultural products, her coal-mines and beds of gypsum will constitute her greatness of resources and her future wealth" (p. 145); and the lead-mines are also of importance.

Chapter 8 of this work (or part 2 of vol. i.) treats of the palæontology of the State as far as concerns the following groups of rocks,—Hamilton group, Chemung group, Burlington Limestone, Keokuk

Limestone, St. Louis Limestone, Kaskasia Limestone, and the Coal-measures. These Mr. Hall "considered more important in the present state of our knowledge,"—the Lower and Upper Silurian formations having been illustrated in Dr. D. D. Owen's Reports on parts of Iowa and the neighbouring States, and the higher groups, especially the Carboniferous Limestones, not having received so much attention. Twenty-nine elegantly engraved plates and numerous woodcuts illustrate the fossils, among which *Brachiopoda* and *Crinoidea* predominate.

This Report, as far as it extends, appears fully to meet the requirements of the State-survey organized in 1855, and provides the citizens of Iowa with clear information respecting their lands. To geologists at large it is also a very valuable work, providing means of comparison for extensive Palæozoic districts of which previously there was little exact knowledge; and we may look forward to the second volume as being even still richer in "comparative geology;" for it will not only treat of the relations of the Palæozoic rocks, with which Mr. Hall has had a life-long acquaintance, but also of the Secondary formations of the Western Territories, to the consideration of which the same eminent geologist will have brought cautious experience and dispassionate acumen.

Second Report of a Geological Reconnoissance of the Middle and Southern Counties of Arkansas, made during the years 1859 and 1860. By DAVID DALE OWEN, Principal Geologist; assisted by ROBERT PETER, Chemical Assistant; M. LEO LESQUEREUX, Botanist, and EDWARD COX, Assistant-Geologist. Philadelphia, 1860.

This Report completes the preliminary Geological Survey of Arkansas; the First Report, by Dr. D. D. Owen, published in 1858 (the result of explorations in 1857-58), having treated of the northern counties of the State. Our knowledge of the geology of this extensive tract of country has hitherto been very vague. One of the most western of the States, Arkansas has been one of the latest in being systematically surveyed by professional geologists. The Survey was placed in excellent hands; for few, if any, were so well acquainted with the soils and rocks of the central area of North America, traversed by the Mississippi, as the late Dr. David Dale Owen. Unfortunately this gifted and energetic geologist has lived but long enough, and scarcely that, to take a general view of the geological structure of Arkansas, and to point out its chief features, mineralogical and stratigraphical. But this was no light task, even with the aid of the gentlemen mentioned above as his assistants, as well as Mr. Jos. Lesley, his topographical assistant, working with him as friends only can work—with zealous co-operation. In the sad duty of preparing for the press that portion of the Report which existed only in the form of field-notes at the time of Dr. D. D. Owen's decease, his brother (Dr. Richard Owen) was cordially assisted by Messrs.

M. W. Smith, J. P. Lesley, and E. T. Cox. The last-named offers, at p. 402, a feeling memorial to the energy and worth of his esteemed friend.

In the Introduction to the Report (p. 7), and again at pp. 16, &c., we find some lucid remarks on the value of a general survey of the geology of a new country, and particularly of Arkansas. Besides establishing the chief axis and trend of the strata, that give not only the contour to the topographical features of the district, but afford a clue to the great folds or troughs in conformity with which some of the strata, appearing at one time in elevated position in the mountain-ranges, sink beneath the surface to reappear, perhaps, on the opposite side of some wide valley, such a geological reconnaissance supplies an approximate knowledge of the boundaries of the formations, enabling the geologist to predict what valuable minerals may be found within their limits, and what it would be useless waste of time to search for within the same. Thus the State-geologist here is enabled to speak with more or less certainty of the locality, nature, and origin of the brine-springs and mineral-waters, the coal-beds and lignites, the iron-, zinc-, manganese-, lead-, and copper-ores, the limestones, marbles, clays and marls, slates, hone-stones, and building-materials, paints, nitre-earths, crystals, &c., of Arkansas.

"Yet Arkansas," wrote the hopeful geologist, in the introductory portion of this his posthumous Report, "is a young State; and her geological survey is in reality only fairly commenced. If thus early in this work we are able to report such flattering prospects, what may not be anticipated by thorough and minute detailed surveys?"

In the Agricultural Survey, numerous analyses of the soils of this State were made, which induced Dr. Owen to believe that its soils generally are equally rich in fertilizing ingredients with those of the neighbouring States, and that its best bottom-lands are, in truth, richer. More mountainous than Iowa, Wisconsin, and part of Minnesota, Arkansas has a greater abundance of timber, and a shorter winter. Pine-timber is of very general growth in this State, due probably (says the author) to the diffusion of silicate of potash in the soil. "So peculiarly indigenous does the yellow pine appear to be to the Arkansas soils, that you will even find it growing in river- and creek-bottoms, side by side with the Gum, and, on the argillaceous slopes, associated with the Beech." Poplar-timber is said to be entirely absent, except on quaternary soil at one locality. The Cretaceous soils of the south-west counties of the State, highly charged with lime, are peculiarly congenial to the Osage Orange or Bois d'Arc. M. L. Lesquereux enumerates eight species of Grape (p. 353) as having been found in Arkansas, in some localities with fine growth; but the people do not seem to appreciate the Vine (p. 329).

Protruded masses of igneous rocks (granitic, hornblendic, and augitic), of small extent and distant from each other, occur on the waters of the Fourche (Pulaski county), in Saline county, and at Magnet Cove, in Hot Spring county; these lie on a N.E.-S.W. line. The general strike of the stratified rocks is stated to be most probably nearly E. & W. These are greatly disturbed and altered near this

granitic axis; and not only here, but over a very wide area removed from this locality, the shales, sandstones, and limestones occur in a greatly metamorphosed state, highly tilted, and often traversed by mineral veins*. The tilted edges of the sandstones and shales are crossed along the roads for miles, and, though there are reversals in the dip evident in places, they must be of immense thickness. "They all seem to be of the age of the Millstone-grit, or, at least, not lower than the base of the Subcarboniferous group, because they overlie rocks of Devonian date, and have intercalated, towards their base, limestone and black flint, which, though often brecciated and metamorphosed into a black-veined marble, are undoubtedly of the same age as the black limestone and flint of Wiley's Cove and Shield's Bluff, which belong to the date of the (Productus-) Archimedes-Pentremital beds of the Subcarboniferous group." They appear to immediately underlie the true Coal-measures. The induration of these strata in Arkansas the author attributes to the highly heated gases, vapours, and alkaline siliceous water,—the various degrees of change observable arising from differences in the intensity and phases of such agencies. The *pervious* sandstones are much more altered than the *impervious* shales. The latter are, for the most part, only locally indurated into hard slates, undergoing rapid disintegration on exposure. Sometimes they are permeated with veins, and network of veins, of milky quartz. Rarely the siliceous shales become good roofing-slate. The sandstones, over many wide areas, are not only indurated, but often completely changed in structure, passing into quartzite, chalcedonic chert, flint, and novaculite. South of the parallel $34^{\circ} 30'$, in Hot-Spring, Saline, Montgomery, and Polk counties, there is less limestone intercalated with the slates, and these have more quartz-veins, generally running at an acute angle with the strike, which most frequently is W. 20° S. and E. 20° N.

The Coal-measures of Arkansas are more fully treated of in the First Report, 1858. They belong to the Millstone-grit, and lie below the horizon of "No. 1 Coal" of the Kentucky sections. One or two hundred feet of shale overlies massive conglomerates or thick-bedded sandstones; and these overlies reddish and dark-coloured shales, upwards of 300 feet thick, which, in their upper part, contain thin seams of coal. The shales appear to have been thrown into wide troughs before the deposition of the sandstone. The Arkansas Coal-field is traversed by the Arkansas River; the strata are nearly horizontal; it contains several thin seams of coal, and there are some from 4 to 5 feet thick. From these Coal-measures M. Lesquereux has obtained upwards of forty species of plants, belonging to twenty-five genera; also the wing of an Insect (*Blattina vetusta*, Lesq.). These fossils are described by M. Lesquereux, and figured in five elegantly engraved plates.

* Another granitic axis, reaching the surface on a branch of the Spavinaw Creek, beyond the north-western limits of the State, probably underlies the lead-bearing Subcarboniferous Limestone of the north-west counties of Arkansas and the south-west counties of Missouri.

As in the attempted delineation of the older rocks of Arkansas, so also in the supposed area of the Cretaceous strata, the published maps are very incorrect. "I have not been able to detect (says Dr. Owen) any symptoms of Cretaceous strata, even in deep wells, any further north in Arkansas than Clark county, about two and a quarter miles north-west of Archidelpia, *i. e.* near the line between townships 7 and 8 south, in about latitude $34^{\circ} 6'$. At the fine section exposed on the Arkansas River, at the 'White Bluffs,' *i. e.* about latitude $34^{\circ} 27'$, beds of Quaternary date occupy the higher part of the bluff, while the lower 50 or 60 feet, extending down to the low-water mark of the Arkansas, is most decidedly Tertiary shell-marl of Eocene date, affording the following species:—*Cardita densata*, *Fusus magnocostatus*, *F. Pittonii*, *Corbula Alabamensis*, *Monoceros vetustus*, and others undetermined. Even at a point on the river-bank where a considerable disturbance and tilting of the strata are conspicuous, nothing lower in the geological series can be seen than Eocene Tertiary."

In Southern Arkansas immense numbers of very large oyster-shells lie strewn on the ploughed lands, where the Cretaceous strata come to the surface—*Exogyra costata*, sometimes weighing upwards of four pounds, and *Ostrea vesicularis*. These are collected and made into a superior lime. Bones of sharks and saurians are also found. Dr. Koch collected many bones here, and removed them to Berlin. Two plates (7 and 8) of Cretaceous fossils, some of which are undescribed, accompany the Report.

The Tertiary beds are best seen in section at the White Bluffs: they yield some limestone for lime-burning, and abundance of shell-marl, good for manure; also, in some places, gypsum, large masses of iron-ore, and thick beds of lignite. The last, as well as some lignites occurring in the Quaternary deposits, yield, by distillation, from thirty to forty-five gallons of crude oil to the ton of 2000 lbs.; and for this purpose the lignites are likely to be more profitable than as fuel. A plate illustrating the kind of leaves (of dicotyledonous trees) found in the Tertiary lignites of the "Chalk-banks" of the Mississippi and the red shales of Tennessee is given by M. Lesquereux (pl. 6), who here figures and describes three new species of *Magnolia*, *Quercus*, and *Rhamnus*. Plate 9 illustrates some of the Tertiary shells and fish-teeth.

To the Drift or Quaternary age are referred numerous and extensive drift-deposits, composed mostly of quartz, sandstone, and hard shales and slate; sometimes these are very thick, consisting of coarse material, and containing large blocks. These Drifts have no connexion with the Northern Drift, though possibly partly contemporaneous with it; but have been due, in Dr. Owen's opinion, to the repeated and long-continued movements of the rocks one upon another, during periods of disturbance and upheaval; and some of the Drift may be "of comparatively recent date, perhaps as new as the date of the rise of the Quaternary beds of the Western States out of the great lake-like expansions of fresh water in which they were accumulated."

The agricultural geology of the State (pp. 42, &c.) has received considerable attention from Dr. Owen and his assistants; and the soils have been extensively analysed. Dr. R. Peter's report on the chemical analysis of soils, subsoils, under-clays, clays, and nitre-earths, with some general observations on soils, occupies pp. 163–294.

The thermal waters of Hot-Spring county are fully treated of at pp. 18, &c., and at pp. 101, &c. Silica and carbonate of lime are their most abundant mineral constituents. Their temperature ranges from 100° to 148° Fahr. They issue, with much free carbonic acid, mostly from a snowy-white chalcedonic novaculite (the "Ouachita oilstone," or "Arkansas whetstone"), in upwards of forty springs, on a ridge (Whetstone Mountain) about 250 feet above the valley, and deposit much calcareous tufa. The novaculite varies in character, is much fissured and veined with quartz. In Montgomery county, some twenty miles distant, the sandstones are less altered, but have their joints and planes of stratification filled with fine clusters of crystals of silex, as much as 5 or 6 inches in length, and of unsurpassed purity. The valley below the springs is occupied with silicified slate, traversed by veins of serpentine. No igneous rock is exposed nearer than ten miles off, at Viga Creek, on the borders of Magnet Cove, famous for its magnetic iron-ore and great variety of minerals, including titanite acid (Brookite or Arkansite).

Artesian wells are treated of in chap. 3, including those of Louisville and St. Louis,—the former 2086 feet, the latter 2199 feet deep. Mention also is made of several of the best-known in Europe.

This Report is illustrated with a chart of the principal hot springs in Hot-Spring county, with several plates and woodcuts illustrating the topographical features, and with the engraved plates of fossils already noticed above. M. Leo Lesquereux's Report on the Botany and Palæontology of the State (pp. 295–399) comprises a systematic catalogue of the plants of Arkansas, with useful notes appended. There is also a good index to the whole book.

This useful work must have been very welcome to the inhabitants of Arkansas, and is full of interest to geologists abroad and at home. Its getting-up does credit to the State, whose late Governor, his Excellency E. N. Conway, appears to have warmly and judiciously patronized the Survey. The geological results of the reconnaissance are worthy of the veteran geologist and his assistants; and it is fervently hoped that the detailed survey of the State will be strenuously proceeded with under equally good auspices as soon as peace shall have again calmed existing disturbances in the distracted States of North America.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

Nov. 21, 1861.—Sir Benjamin Collins Brodie, Bart., President, in the Chair.

“The Lignites and Clays of Bovey Tracey, Devonshire.” By William Pengelly, Esq., F.G.S.

The village of Bovey Tracey, in Devonshire, is situated on the left bank of the river Bovey, a small tributary of the Teign, about eleven miles south-westerly from Exeter. A considerable plain stretches away from it, for about nine miles, in a south-easterly direction, and terminates three and a half miles north-west of Torquay. It appears a lake-like expansion of the valleys of the Bovey and Teign, and is surrounded on all sides by lofty hills of granite and other rocks.

Excavations in various parts of this plain, especially in the north-western part of it, known as Bovey Heathfield, have disclosed, beneath an accumulation of gravel mixed with clay and sand, a regular series of strata of lignite, clay, and sand, well known to geologists as the “Bovey deposit,” whilst the lignite is equally familiar as “Bovey coal.”

The most important of the excavations is that known as the “Coal-pit,” whence lignite is extracted, which is used, in small quantities, at a neighbouring pottery, and also by the poorer cottagers of the immediate neighbourhood.

The deposit has long attracted the attention of both the scientific and commercial world, and many authors have given descriptions and speculations respecting it.

In 1760 the Rev. Dr. Jeremiah Milles sent a paper on it to the Royal Society. His aim appears to have been to prove the *mineral* origin of the lignite, in refutation of Professor Hollman, of Göttingen, who had described, and assigned a vegetable origin to, a similar substance found near the city of Munden. In 1794 and 1796 Dr. Maton described the deposit, and mentioned the existence of a large turf bog, near the pit, in which whole trees were often discovered, but “none of them bearing the least resemblance to Bovey coal.” In 1797 Mr. Hatchett brought the subject before the Linnean Society, in a paper in which his object seems to have been the refutation of the mineral theory of Dr. Milles. In his ‘History of Exeter,’ published in 1802, Mr. Brice next gave an account of the deposit, and the state of the lignite workings; he supposed the basin to have formerly been a stagnant lake or morass into which trees were successively transported from the neighbouring slopes. The twelfth letter in Parkinson’s ‘Organic Remains,’ published in 1804, appears to have been written by Mr. Scammell, of Bovey Tracey, and is devoted to the lignite; from it we learn that the coal had been worked upwards of ninety years, and that the trees found in the bog, mentioned by Dr. Maton, were of the fir kind. Mr. Vancouver, in his ‘General View of the Agriculture of the County of Devon,’ pub-

lished in 1808, supposes the lignite to have been the product of pine forests which grew where it is found, and that clay and other moveable matter must have been poured over them, in a fluid state, at different periods, from the craggy eminences around. Mr. Austen, in his ‘Memoir on the Geology of the South-east of Devonshire,’ states that the Bovey beds rest on a gravel equivalent to the lowest tertiary deposits, and is thus the first writer who addresses himself to the chronology of the formation. He makes the overlying gravels post-tertiary, but belonging to the “period prior to the most recent changes of relative level of land and water and of climate.” Sir H. De la Beche, in his ‘Report of Cornwall, Devon, &c.,’ expresses surprise and regret that, excepting the lignite itself, no organic remains have been detected in the deposit, so that we are deprived of any aid by which it may be referred to any particular geological date; and adds that “if the wood be, as has been supposed, analogous to oak and other existing trees, we should suppose the Bovey beds to have been formed towards the latter part of the supracretaceous period.” In 1855, Dr. Hooker read a paper before the Geological Society of London, “On some Small Seed-vessels (*Folliculites minutulus*) from the Bovey Tracey Coal,” which was the first announcement of the discovery of identifiable fossils in the deposit. Besides the fossil just named, Dr. Hooker described a cone of the Scotch fir, *Pinus sylvestris*, said to have been found in one of the uppermost beds of lignite, and from it he came to the provisional conclusion that the Bovey beds belong to the Post-Pliocene epoch. In 1856, Dr. Croker, of Bovey Tracey, sent to the same Society a paper in which he mentioned the occurrence of large “flabelliform leaves,” together “with tangled masses of vegetable remains in some of the higher beds.”

In 1860 Sir Charles Lyell and Dr. Falconer visited Bovey, and returned with the impression that the formation belonged to the miocene age. The latter introduced the subject to Miss Burdett Coutts as one which it was eminently desirable to have fully and carefully investigated. Miss Coutts having soon after visited the district with the author, requested him to undertake an investigation of the deposit, which he accordingly did; and at once engaged Mr. Keeping, the well-known and experienced fossil-collector of the Isle of Wight.

Sections of the deposit at the coal-pit show a series of beds naturally dividing themselves into three parts, namely,—

1st, or uppermost, a bed of sandy clay, containing large angular and subangular stones, chiefly of Dartmoor derivation, unconformably covering the lower beds. No stones occur below this.

2nd. A series of twenty-six beds of lignite, clay, and sand, the base of which is a bed of ferruginous quartzose sand, in some places 27 feet thick, in others less than one foot, but which everywhere occurs as a well-marked feature in the pit-sections. Excepting this bed, sand is almost entirely confined to the uppermost part of the division.

3rd. A set of forty-five beds of regularly alternating lignite and clay.

The stones by which it is characterized, and its unconformability,

show that the uppermost division could not have been formed under the same conditions, nor probably in the same geological period as the two lower series. This view has been confirmed by the identification of certain fossil leaves found in the clays of the uppermost series.

The two lower series are strictly conformable, and dip $12\frac{1}{2}^{\circ}$, towards S. 35° W. (mag.). Five beds—one of clay and four of lignite—in the second series, and nine—one of clay and eight of lignite—in the lower, a total of fourteen, have yielded fossils, all of them remains of plants only. A few only of these beds require particular mention. The seventh bed is, in many places, a mat of the débris of a coniferous tree, the *Sequoia Couttsia*, and fronds of ferns, chiefly *Pecopteris lignitum*. The seventeenth bed contains a large number of dicotyledonous leaves. The twenty-fifth is that in which the so-called “flabelliform leaves” of Dr. Croker occur; they have been decided to be large rhizomes of ferns. The twenty-sixth, a bed of clay, is richer than any other in the number and variety of its fossils, which consist of dicotyledonous leaves, seeds of various kinds, and débris of *Sequoia* stems, leaves, fruits, and seeds. Remains of the last occur, in well-marked specimens, in the fortieth and sixty-third beds; so that it ranges throughout the formation, both divisions of which, therefore, belong to one organic period. The forty-sixth bed abounds in the seeds described by Dr. Hooker as *Folliculites minutulus*, but which Professor Heer has recognized as *Carpolithes Kaltennordheimensis*.

The lignite has frequently a “charred” appearance; and it is difficult to believe that it has not undergone true combustion in the beds, the ignition being spontaneous.

Coal has been found upwards of 170 feet below the surface of the plain, and there are reasons for believing that the deposit is fully 300 feet in depth.

On the advice of Dr. Falconer, the fossils have been submitted to Professor Heer of Zürich, who has found amongst them 49 species of plants, eight of which were found by himself during a personal investigation of the deposit. Many of these are entirely new to science, whilst the others are well known as continental representatives of the lower miocene age. In addition to these, four species have been identified in the uppermost or gravel division, as belonging to the diluvial period, “that is, a period when the climate of Devonshire was colder than at present.”

The deposit is eminently freshwater, and must have been formed in a lake, the bottom of which is, at present, at least 30 fathoms below the level of ordinary spring-tide high water. It appears probable that the waters of this miocene lake were separated from the ocean by a barrier which crossed the present tidal estuary of the Teign, and over this the surplus waters passed to the sea; or that they formed a lower outlet in the valley between Newton and Torquay; the first seems, from the physical characters of the two valleys, to have been the most probable course. During the investigation a search was made for fossils at the clay-works of Aller, Kingsteignton and Decoy, all near Newton Abbot; nothing was

found except at the last place, where a stem of *Sequoia Couttsiae* was met with, thus showing that the deposit is identical with that at Bovey Heathfield.

“The Fossil Flora of Bovey Tracey.” By Dr. Oswald Heer, Professor of Botany and Director of the Botanical Gardens in Zürich.

The surface-covering of the Bovey plateau consists of a light-coloured quartzose sand, which contains here and there considerable beds of white clay. By the plants contained in it this formation is assigned to the Diluvium.

Immediately under it come the beds of clay and lignite, which belong to one formation, far older than that of the overlying white clay; the plants found in them determine them as belonging unquestionably to the miocene period. Hence the formations must be treated of separately.

A. The Miocene Formation of Bovey.

Of the forty-nine species of plants hitherto discovered in the lignite beds of Bovey, twenty occur on the Continent in the miocene formation. Those beds are therefore undoubtedly miocene. When tabulated, it is seen that fourteen of the twenty species occur in the Tongrien étage, thirteen in the Mayencien, five in the Helvétien, and eight in the Ceningien; hence the Bovey lignites must be ranged in the under miocene, and in the Aquitanien étage of it.

Moreover, the *new* species at Bovey are closely allied to well-known Continental forms on this horizon.

It is remarkable that Bovey has no species in common with Iceland, although the tertiary flora of the latter belongs to the same period, and two of its species have been found in the miocene deposit of Ardtun Head in Mull. The Bovey flora has a much more southern character, manifesting, indeed, a subtropical climate.

It has certainly some points of connexion with the cocene of the Isle of Wight, but on the whole possesses an essentially different character. The fact that but one species is common to it and Alum Bay, whilst it has so many in common with the more remote miocene formations of the Continent, satisfies us that it belongs to a different horizon.

Among the twenty-six new species found at Bovey, several interesting forms are found. The first place belongs to *Sequoia Couttsiae*, a conifer which we can illustrate by branches of every age, by cones and seeds. It supplies a highly important link between *Sequoia Langsdorffii* and *S. Sternbergi*, the widely distributed representatives of *S. sempervirens* and *S. gigantea* (*Wellingtonia*), whose occurrence in the present creation is confined to California.

Of great interest also are two species of *Vitis*, of which the grape-stones lie in the clays of Bovey. Three remarkable species of Fig, the seeds of three new species of *Nyssa* and two of *Annona*, one new water-lily (*Nymphaea*), and many highly ornate Carpolithes impart to our knowledge of tertiary plants a most essential extension.

It is highly probable that, at the period of the lower miocene, the

Bovey basin was occupied by an inland lake. The entire absence of freshwater shells, and, indeed, of aquatic animals generally, is certainly very extraordinary, and so is the absence of fruits of the *Chara*, so abundant elsewhere in miocene freshwater deposits; the *Nymphæa* seeds, however, furnish a secure indication of fresh water. We must not omit to notice that the parts of the basin hitherto explored were towards the middle of the lake, and, in the case of the under beds at least, at a considerable depth, which explains the absence of bog-plants as well as of mammalian relics.

The lignite beds consist almost entirely of tree-stems (probably belonging in great measure to *Sequoia Couttsiæ*) which have apparently been floated hither, not only from the circuit of the immediate hills, but doubtless also from greater distances.

The twenty-sixth bed in the series, immediately above the "thick bed of sand," is a soft clay with numerous leaves of plants, and ripe cones and seeds of *Sequoia Couttsiæ*; the bed was probably formed in autumn, and the plants it contains are due to the driftings of that season. Higher up follows the bed (twenty-five) with fern rhizomes, and occasionally pinnules of *Pecopteris lignitum*. The latter appears in great abundance with branches of *Sequoia* still higher.

As this under miocene formation is immediately succeeded by that of the gravel and white clay, we have here a great hiatus: either the middle and upper miocene, as well as the pliocene, periods must have passed without the formation of deposits in this place, or they must have been removed again in the diluvial period.

B. The White Clay.

While the lignites and their alternating clays present us with a subtropical vegetation, the plants of the White Clay exhibit a totally different character, and must have had their origin in an altogether distinct period.

Four species—three of *Salix* and one of *Betula*—have been found in this overlying mass, no one of which appears to differ from species now living. The presence of the *Betula* (*B. nana*) is conclusive for a diluvial climate, that is, a colder climate than Devonshire has at the present day; for this dwarf birch is an Arctic plant, which has no British habitat south of Scotland, and which occurs in Mid Europe only on mountains and sub-alpine peat mosses. The evidence of the willow-leaves is to the same effect, indicating that at this period Bovey Heathfield was a cold peat-moor.

ZOOLOGICAL SOCIETY.

June 25, 1861.—Dr. J. E. Gray, F.R.S., V.P., in the Chair.

NOTES ON THE SEA-ANEMONES OF MADEIRA, WITH DESCRIPTIONS OF NEW SPECIES. BY JAMES YATE JOHNSON.

In the following notes I have given an account of such Sea-Anemones as have occurred to me after much diligent search in the neighbourhood of Funchal, the capital of Madeira. The dredge

would doubtless bring other species to light, and possibly something additional would be discovered by an examination of the shore in other parts of the island. As to the nomenclature of the genera, I have considered it right to follow Mr. Gosse, to whom all students of this tribe of Zoophytes must feel much indebted for his painstaking book on the British species.

A *Cornularia* is included ; for although not, strictly speaking, a Sea-Anemone, it closely resembles one in external appearance.

Order ALCYONARIA, M.-Edw.

CORNULARIA ATLANTICA, sp. n.

Basal band narrow, inconspicuous, creeping irregularly, and bearing the polypes at uncertain distances. Column of a pale flesh-colour, subcylindrical, rather wider at the middle than above and below ; destitute of spicula, but invested by a thin epidermis containing particles of sand ; when retracted, forming a fleshy hemispherical button, one-fifteenth of an inch high ; when expanded, the column has a length of about three-tenths of an inch, with a diameter of one-twelfth of an inch. Eight pinnate tentacles, in one series, at the margin of the shallow cup forming the disk, the pinnæ of about twelve pairs, ringed, as if showing a tendency to further division. Tentacle-stem subulate, about one-fourth of an inch in length, the bases of the tentacles broadening and coming in contact one with another on each side. When the animal is fully displayed, the tentacles and the upper part of the column are nearly colourless, and have the appearance of a transparent film.

Abundant on stones near low-tide mark ; sometimes attached to sea-weed.

Order ZOANTHARIA, M.-Edw.

Suborder ACTINIARIA, M.-Edw.

Fam. ACTINIIDÆ, M.-Edw.

SAGARTIA PARASITICA, R. Q. Couch, sp.

This species is invariably seated upon shells inhabited by Hermit Crabs, *Cassia sulcosa*, *Dolium perdis*, *Triton nodiferus*, &c.

SAGARTIA AFFINIS, sp. n.

This species is closely allied to the last, and like it is always found upon shells of which Hermit Crabs have taken possession, sometimes in company with it, sometimes alone. Its base is capable of great extension ; and its column rises pillar-like, of a diameter very much less than that of the base. When contracted it will often lie so flat as to be scarcely thicker than a sixpence. The ground-colour of the column is yellow ; and there are five broad, more or less fuscous longitudinal bands, which, when the body is contracted, lie star-like upon it. Sometimes there is an irregular whitish transverse band placed nearer the disk than the base ; and in some specimens a number of white longitudinal streaks have been observed near the base. The inside of the mouth is orange. The disk itself is yellowish, the tentacles grey, numerous, in four or five rows. The

average size of this species is less than that of *S. parasitica*, the largest specimens of which I have never seen equalled by any of *S. affinis*. Near neighbours in habit and mode of life as these two may be, I have never observed any passage from one form to the other, although a good many specimens have been met with. It is an eager and voracious feeder, and bears captivity very well. It will sometimes transfer itself from the shell to the bottom of the tank, and after a while, lo! it is seated on the shell once more, the shell being all the time the abode of a restless *Pagurus*.

PHELLIA VESTITA, sp. n.

Base adherent to rocks, less than column. Column cylindrical when expanded, clothed with a dense, brown, closely-adherent skin, rough like wash-leather, which when forcibly stripped off discloses the true skin beneath, which is smooth and of a pinky red. The animal is able to protrude the lower part and the upper part of its column from beneath the epidermal covering, which seems to consist chiefly of mucus and fine mud blended together. In a contracted state it is wrinkled transversely, but not warted. Disk smooth, reddish, with radiating marks of brown and white. Tentacles numerous, in three rows, crowded near margin of disk, of moderate length, the innermost row the longest; retractile, conical, rather broad at the base, pale red, more or less ringed and spotted with opaque white: sometimes the dilated bases have a dark neutral-tint band, and below this a white band round them. Mouth not raised on a cone, but sometimes puffed out. Acontia emitted sparingly.

This Sea-anemone is able to take considerable variety of shape; sometimes it is contracted, sometimes swollen out at the middle, and when irritated into a state of complete contraction, it has a very rugose appearance. When detached from any support, I have seen it contract its base so much that a small hole only was visible. It has the power of expanding or distending both the lower and upper parts of its body, the expanded portions becoming semitransparent, and assuming the appearance of bladders, whilst the rest of the column retains its rough opaque coating. This coat adheres so strongly, that I have in vain endeavoured to remove it with my finger-nail from a healthy animal. From a specimen, however, which had been severely wounded in removing it from its native rock, I succeeded in peeling off the coat in patches. The animal is not timid, it will keep its tentacles expanded until it is touched; but in the day-time it seldom pushes them out to their full stretch; they are usually held curved over the margin of the disk. It is rather fond of ascending the side of the tank until it nearly reaches the surface of the water; then, attaching itself by part of its lower disk, it will bend its body loosely downwards at an angle of 45° . It is hardy in the aquarium, rather sluggish in its habits, and adheres firmly to its support. It is not uncommon under stones in pools amongst the rocks covered at high tide. The size is not great; the largest I have seen measured about half an inch in height when contracted, and expanded to a length of about an inch and a half.

AIPTASIA COUCHII, W. P. Cocks, sp.

Not very common : usually found under loose stones near the level of low tide. It preserves at Madeira all the chief characters and habits possessed by its British sisters—restlessness of disposition, flexuosity of tentacles, power of lengthening and contracting the column, love of attaching itself to the side of the tank near the surface of the water, the column hanging downwards with the disk and tentacles widely expanded ; lastly, eagerness in seizing and swallowing its food. Sometimes it will abandon all support and suspend itself freely in the water, base uppermost, remaining thus for several hours without moving, save in being continually employed in distending the column laterally. The distention began to show itself at the disk, and travelled slowly along until it reached the base ; when this had been effected, the animal stretched itself out and then recommenced the operation. One of my specimens, now living in a glass of sea-water, presented itself one day as a globular vesicle three-quarters of an inch in diameter. The disk and tentacles had been retracted, and the tips of some of the latter were just visible at the bottom of a depression resembling that seen at the top of an apple.

ANTHEA CEREUS, Johnston.

This species is by far the most abundant of the Madeiran *Actinaria*, being found in almost every pool on the rocks between tide-marks. It is undoubtedly the animal described in Dana's great work under the name of *Actinia flagellifera* (*Comactis flagellifera*, M.-Edw.).

ACTINIA MESEMBRYANTHEMUM, Ellis & Sol.

This species stands next in regard to abundance. The commonest variety is coloured a red-purple, with numerous black dots on the column. Sometimes the spots are greenish grey, sometimes the marginal spherulæ are red-purple instead of being azure. The animal is frequently of an umber-brown ; and a few specimens have occurred which had a brown body and disk, with red-purple base and tentacles. Two specimens have been met with which had a dull-green body and tentacles, with a white base, blue marginal spherules, and a blue line at the junction of the column with the base. At the time I possessed these two *Actiniae* a third specimen was obtained, slightly different from them ; and this was placed in the same glass. On looking at them after the lapse of a few hours, I found that the new comer was in contact with one of the others, and that six of the marginal spherules of the latter on the side of contact had expanded into large, colourless, ovate vesicles, retaining only their original blue colour at the tips. The upper part of the body of the animal was separated at this time from the tentacle-bearing disk by a deep fosse. Subsequently more of the blue tubercles expanded, until ten in this state were counted ; after a while the disk expanded laterally, the vesicles contracted, and the fosse disappeared. Whilst the vesicles existed, the tentacles in their neighbourhood became much reduced in diameter, so as to be filiform. I am not aware whether a similar phenomenon has been observed by others.

ACTINIA VIRGATA, sp. n.

Base of a deep flesh-colour, adherent to stones, not much exceeding the column when the tentacles are expanded; when these are withdrawn and the column is depressed, it frequently spreads out into an enlarged irregular oval. Column delicately smooth, imperforate, non-adhesive; substance fleshy, marked by numerous (45 to 50) pairs of straight, purplish-blue lines, which extend from the margin of the disk to the angle of the column and base, where there is a circumferent line of the same colour. Each of these lines is about half as wide as the space between any two; sometimes a line is broken up into dots. When the animal is in a contracted state, the lines are brought so close together, and their colour so deepened, that it appears nearly black. The disk has the margin closely set with azure tubercles, about thirty in number; it is smooth, of a pinkish flesh-colour, often puffed out into a cone, at the top of which is the mouth. Tentacles about eighty in number, crowded in three or four rows, placed near the margin of the disk, moderately long, with little difference between dimensions of those in the several series, conical, of a pale-brown colour, with a slight purple tinge. When contracted, of a dark sepia-brown. Mouth with an azure-blue spot at the opposite angles. Acontia, none observed.

Size from half to three-quarters of an inch in height, and from one-third to one-half an inch in height.

Found on the underside of stones in pools near low water-mark.

This pretty species is not very common: it is of very quiet habits, and dislikes the light. When in the aquarium it hardly ever expands its tentacles in the day-time, and at night, if brought within the influence of light, the animal immediately takes alarm. A specimen is now living in one of my tanks. A few days ago, on looking at it after an interval of four or five hours, I found, to my surprise, that it had in the meantime surrounded itself with a progeny of fourteen young ones, the average size of which was one-tenth of an inch in height and diameter, though some were smaller and some nearly twice as large. They were of a dull flesh-colour; but on the larger ones the purplish-blue marks began, in the course of a few hours, to show themselves as rows of dots, with irregularly arranged dots filling up the spaces between the rows of each pair. Some of them displayed their tiny tentacles in a ludicrously old-fashioned manner. As to the mother, she had contracted her tentacles until they were little more than papillæ; the disk was puffed out much beyond their tips; and the mouth was gaping widely, displaying a red throat; the base was quite free, and was altogether concealed by the contraction of the body.

BUNODES LISTERI, sp. n.

Base adherent to rocks; its diameter about equal to the height of the column. Column, when expanded, usually from half to three-quarters of an inch in height; but one specimen extended itself to the length of an inch and a third, with a diameter of four-tenths of an inch. Surface red, beset with longitudinal rows, about twenty-

four in number, of small white tubercles, which have a spot or streak of red at their apices. There are from ten to sixteen tubercles (taking different specimens) in a row; these tubercles can be employed as suckers, and by them I have seen the animal adhere to the bottom or side of a glass in which it was living; the alternate rows sometimes cease with the third or fourth from the disk. Disk frequently cup-like, without marginal spherules, very transparent, with a row of small white spots at the inner base of the innermost series of tentacles: sometimes there are white spots between the tentacles. Margin of disk uneven, by reason of the highest tubercles of the column forming part of the outline. Mouth with a pale ring around it. Tentacles numerous, in about three rows near the margin of the disk, those of the innermost row longer, and these are as long as the diameter of the column, decreasing in size outwards, pale flesh or brown, but sometimes bearing white opaque spots, very pellucid, conical, simple, readily retractile, and usually brown, curled at the tips.

This pretty species is very distinct from all the other Madeiran species that have occurred, but it seems to be closely allied to the British *Bunodes Ballii*. The pale-red, diaphanous tentacles become in some cases, when contracted, of a red-purple colour, in others of a brown hue. In one specimen, which was brought to me much wounded, the red tubercles of the column were ringed with greenish yellow. The animal is rather impatient of light, and is only seen fully expanded at night. It adheres very firmly to the object it is seated upon, and will submit to be torn rather than loosen its hold.

I have named this species in honour of Dr. N. Lister, of Funchal, to whom I am indebted for much sympathy and assistance in my investigations.

ALICIA, gen. n.

Base adherent at pleasure; greatly exceeding column. Tentacles simple. Margin of disk simple, without spherules. *Column beset with stalked appendages.*

ALICIA MIRABILIS.

Base pale brown, adherent apparently by means of minute round suckers scattered over it, capable of great dilatation, and sometimes having a diameter of between 4 and 5 inches; very transparent, so that the appendages on the column could be seen through it. The outline undulate; the surface marked with about a hundred radiating furrows, meeting in the middle, and causing the margin to be crenate. Column apparently imperforate, pillar-like, when fully expanded measuring $2\frac{1}{2}$ inches in height and diameter; surface delicately soft, pellucid, pale brown, marked with longitudinal furrows corresponding with those on the base; beset with stalked appendages. At the base these appendages are small, nearly sessile, and bear at their summits a single wart of hemispherical outline and of a dull-purple hue; they become larger in proportion to their height above the base, until those next the oral disk have stalks half an inch high and $\frac{3}{10}$ of an inch in diameter, which divide and redivide, each ultimate division always crowned with a wart. As many as sixty warts

might be counted on one of these appendages, the appearance of which when half-contracted, had some resemblance to a head of cauliflower. In most cases the common stalk was of an opaque white colour, but

1



4



2



3

Fig. 1. *Alicia mirabilis*, as seen with the base detached and uppermost, the tentacles lying on the bottom of the tank.

Figs. 2 and 3. Two of the appendages of the column, of the natural size.

Fig. 4. One of the warts of an appendage, enlarged. The outer coat is colourless and transparent; the top of the interior body is dull purplish, the lower part yellowish brown, and the interspace colourless.

in other cases it was orange; and there were two of this colour standing higher up the column than the rest, and placed over against each other. When the animal was in its state of greatest contrac-

tion, no part of the column was visible, on account of the warted tops of the appendages forming an unbroken coat; when fully expanded, the soft delicate body was seen between the separated appendages, and the upper part near the disk was extended quite clear of them for a considerable space. Under the microscope the purple warts were seen to consist of an exterior, transparent, colourless coat enveloping a body which was purplish at the tip and pale brown below. Disk destitute of marginal spherules, not lobed nor extending beyond the column, pale brown, transparent, slightly cupped. Tentacles pale brown, simple, subulate, elongated, rather slender, often curled, numerous, compactly set in three rows near the margin of the disk, beset with minute papillæ. Mouth half an inch across; lips usually somewhat puffed out, and divided by deep furrows into six longitudinal ribs on each side; destitute of warts and tentacles. Throat of a pretty full brown. No acontia observed.

But one specimen of this very curious animal has occurred; it was brought to me alive in the month of April last, and was said to have been found in one of the cane-work baskets which are sunk to the depth of a few fathoms in the Bay of Funchal, chiefly for the purpose of taking red mullet (*Mullus surmuletus*, L., and *M. barbatus*, L.). When I first saw it, only just covered with a little water, it was in a contracted state, and my first impression was that a compound Ascidian was before me. After keeping it for three weeks in a small tank, I attempted to bring it with me to England in order to show it to those interested in this tribe of animals; but being unfortunately unable to attend to it in the earlier part of my voyage, it perished, to my great regret.

As to its habits during the time it lived in my tank, I may say, that it bore confinement very well, and took its food (the flesh of *Patellæ*) with considerable readiness. It frequently shifted its position in the tank, and on one occasion it was seen floating base uppermost; when attached, its upper part was seldom destitute of motion, but that motion was exceedingly slow. The tentacles were usually more or less displayed; but it has been observed with them so completely withdrawn that it was not easy to discover the precise situation of the disk and mouth. The tentacles possessed the power of stinging; but, though the skin was made red, the pain was not great.

Fam. CERIANTHIDÆ, M.-Edw.

SACCANTHUS MADERENSIS, sp. n.

Column lengthened, worm-like, with a conical *imperfurate* base; skin smooth, apparently without suckers or loopholes; of a pale chestnut-brown colour; enveloped in a loose non-adherent tube secreted by the animal, open at both ends. Disk without marginal spherules, cup-shaped, capable of being expanded so as to have a diameter twice as great as that of the column. Tentacles of two kinds: 1st, marginal, twenty-four in number, in one series, but often arranged, when fully displayed (and then bending inwards and outwards alternately), so as to have the appearance of being placed in two rows; these tentacles are slender, tapering, uniform, longer

than the diameter of the column, and are coloured brown with pale rings: 2nd, short filiform tentacles, about twenty-five in number, arranged in two or three irregular circles round the mouth, coloured a uniform brown; these labial tentacles hardly equal in length the radius of the disk.

Only one specimen of this interesting animal has fallen in my way. When first brought to me, its appearance was that of a mass of dirt which had a certain convoluted shape, and out of which protruded at one place a reddish semitransparent body (the base), and at another some tentacles, which partly folded up on being touched. At first sight I took the animal for an Annelid; but during the night it shuffled off its muddy coating and displayed itself in its true character. It was then seen to have a length of about $2\frac{1}{2}$ inches, with a diameter of about a quarter of an inch. The column was quite smooth, cylindrical, and of a brown colour approaching to auburn or chestnut. When examined with a lens, some fine longitudinal lines were perceived, dividing the body at regular intervals, and being about $\frac{1}{10}$ of an inch apart. Faint angular transverse lines were also visible, pretty closely set. It seemed shy, and never expanded its tentacles completely, except in the dark, when it contracted them if the light of a candle fell upon it. The power of fully withdrawing them seemed to be wanting. They were more than an inch in length when entirely displayed. The next day I perceived it lying in the angle at the bottom of the glass containing sea-water, enveloped in a glaucous semitransparent film of mucus looking like a stout spider's web, in which it moved as a worm moves in its case. It had expanded to a length of $4\frac{1}{2}$ inches, but on being touched immediately contracted so as to measure only $1\frac{3}{4}$ inch. It possessed the power of swelling out portions of the column; sometimes the swelling appeared near the middle of the body; sometimes near the base. On some occasions it lay with the lower part of the body bent into a hook; at others it quitted the protection of its tube and floated at the surface of the water. The animal was never observed to wriggle or glide through the water like a worm; all its motions were extremely slow. It was captured at the bottom of a pool in the rocks near Funchal.

MISCELLANEOUS.

Note on Physa acuta (Draparnaud).

By the Rev. ALFRED MERLE NORMAN, M.A.

To the Editors of the Annals of Natural History.

GENTLEMEN,—In February last I described in your Journal the well-known European Mollusk, *Physa acuta* (Draparnaud) as having been met with in our Islands. It was mentioned in my paper that the species had been found in a tank at Kew Gardens, and also in "a ditch in the immediate vicinity of London." This last locality was a "brook near the Hampton Wick entrance to Bushy Park;" and the species was presumed by Mr. Choules to have been introduced from this habitat, along with water-plants, into Kew Gardens.

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Specimens sent to me as from the brook were identical with the tank species; and therefore, not seeing any reason to question the correctness of the information received, I did not hesitate, in accordance with Mr. Choules's wishes, to publish the species. It is with much regret that I have now to state that it would seem I have been misinformed by Mr. Choules, and that the species does *not* occur in the brook in Bushy Park. *Physa acuta* must therefore be presumed to have been introduced into Kew Gardens from an exotic source.

Believe me to be, Gentlemen,

Your obedient Servant,

Sedgefield, Dec. 30, 1861.

ALFRED MERLE NORMAN.

On the Reproduction of Porpita. By M. LACAZE DUTHIERS.

At the end of August and about the middle of September, strong gales from the north-west threw upon one of the beaches near La Calle some *Porpita* in good condition; some of them, preserved in my aquaria, displayed their fringed tentacula, moved from place to place, and soon let fall to the bottom of the vessel a great number of small ovoid bodies marked with a white cross.

Having seen the small Medusæ of the *Velella*, I soon, by the aid of the lens, ascertained that I had before me exactly similar objects: under the microscope no doubt was possible.

The Medusæ of *Porpita* present the form of a little bell, of which the margin is furnished with a delicate membrane, and the summit bears a mass of brownish matter formed of large globules or cells. Starting from the bottom of the bell, four bands of a very dead white run almost to the margin of the orifice; the rest of the surface is as transparent as crystal. In the thickness of the tissues are lodged some small white bacilli, which give their colour to the bands; and outside these are scattered wide apart some large neurato-cysts, which raise the surface, and almost project from it.

The movements of contraction are exactly similar to those performed by all the Acalephs of this form; they are brisk and intermittent. When the contraction is effected, the water which fills the bell is driven out, and pushes before it the little membrane which borders the orifice.

These little Medusæ are easily recognized, with a lens, from their movements: the arms of the little white cross formed by the bands separate from and approach each other in the dilatations and contractions.

I could not get these young *Porpita* to live more than ten days; and all the changes which I could observe in them were limited to the almost complete disappearance of the large brown granulations at the summit of the bell, the increase of some yellowish granular cells which are observed on each side of the white bands forming the cross, the disappearance of some neurato-cysts, and, lastly, the formation at the summit of the bell of a cellular nipple, the further transformations of which could not be traced.

The little bodies just described detach themselves from the very numerous tentacles which surround the central trunk and clothe all

the lower surface of the disk from the filaments covered with barbules which occupy the circumference.

Each of these proliferous tentacles forms a regular raceme, of which the grains are small Medusæ in different states of development; they are suspended from a pedicle by the pole opposite to the orifice of the bell. The extremity of the tentacle is inflated, and presents an orifice.

A little later, about the 15th of September, the same winds blowing, I again met with *Porpitæ*, but this time very much damaged; nevertheless they still bore bunches of little Medusæ; and some *Veellæ* which I collected in better condition, in the same locality, furnished me with very numerous little medusiform corpuscles. In relation to the period of reproduction, this fact is worthy of remark. In 1858, during the month of May, I obtained great quantities of Medusæ from *Veellæ*, which I was able to observe for a considerable time. If, therefore, the reproduction takes place in Africa as in Corsica, we may conclude that the production of the little medusiform corpuscles goes on for a long time.—*Comptes Rendus*, Nov. 11, 1861, p. 851.

On some Points in the Anatomy of the Apteryx australis.

By Prof. HYRTL.

The lumbar artery of this bird, when it arrives at the popliteal flexure, is divided (as it is generally) into two tibial arteries—an anterior and a posterior. The first of these, after having passed the interosseal tibial space, passes back over the plane of extension and the articulation of the knee to supply the anterior muscles in the femoral portion of the leg. The other artery also passes through the intertibial space, to come in front of the tibia, leaving behind it a very feeble branch, sufficient for the supply of the scarcely developed post-tibial muscles. The main branch runs downward between the extensors of the toes to the back of the tarsus, where it ramifies into digital arteries. Between the middle of the tibia and the centre of the tarsus, this artery is surrounded on all sides by an arterial plexus (rete mirabile), divided into a number of delicate branches, leaving a distinct impression on the corresponding portion of the tibia. If carefully examined, no doubt similar impressions might be found on the tibia of *Dinornis*, *Notornis*, and other extinct forms, whose only still extant representative is the *Apteryx australis*.—*Imp. Acad. Vienna*, Meeting, Oct. 10, 1861.

On a gigantic Cuttle-fish, found in the Atlantic Ocean, between Madeira and Teneriffe.

Several instances are on record of the occurrence of enormous Cephalopoda, which almost seem to warrant the belief, formerly prevalent in Scandinavia, in the existence of the *Kraken*. M. Milne-Edwards quotes Aristotle as speaking of a great Cuttle-fish five fathoms in length, and refers to other observers, such as Péron, who found, in the waters surrounding Tasmania, a Squid, of which the

arms measured 7 or 8 inches in diameter, and 6 or 7 feet in length ; Quoy and Gaimard, who collected in the Atlantic, near the equator, the fragments of an enormous mollusk of the same kind, the weight of which they estimated at 100 kilogrammes ; and Rang, who saw, in the same waters, a Cephalopod of a red colour, with a body the size of a large cask. A specimen of one of those monstrous Cuttle-fishes was thrown upon the shores of Jutland in 1853 : its body, which was cut up by the fishermen for bait, furnished loads for several wheel-barrows ; and the pharynx, which was preserved, is as large as a child's head. This animal was described by M. Steenstrup under the name of *Architeuthis dux* ; and M. Moquin-Tandon mentions that M. Steenstrup showed M. Auguste Duméril a portion of one of the arms, as thick as a man's thigh. Fragmentary specimens of a similar nature are contained in the Museum of the Royal College of Surgeons in London, and in that of Utrecht ; those in the latter have recently been described and figured by M. Harting.

A specimen of one of these enormous mollusca has just been seen by the crew of a French man-of-war, and escaped capture only by leaving a part of his tail behind him. On the 30th November last, at two in the afternoon, the French steamer 'Alecton,' being then about 40 leagues N.E. of Teneriffe, fell in with a gigantic Cuttle-fish, of a brick-red colour, which appears to have been disporting itself at the surface of the sea. The captain gave immediate orders to attempt its capture ; but a strong gale which was then blowing caused the ship to roll much, and rendered its handling difficult, whilst the monster, apparently foreseeing the fate that was preparing for him, displayed great intelligence in avoiding the vessel. He was, however, hit with several bullets, and at last struck with a harpoon, and seized by a cord with a slip-knot. At this moment, when every preparation was being made to secure it, the animal, by a sudden violent movement, drew the harpoon out of its soft flesh, and at the same time the noose slipped over its skin down to the caudal extremity, where it held, but in hoisting the animal out of the water the part thus seized broke off, and only a fragment, weighing about 20 kilogrammes, was brought on board. Both sailors and officers were anxious to have a boat lowered in order to go in pursuit of the creature ; but the captain, fearing lest some harm should happen to the boat's crew in their struggle with so novel an opponent, declined this step, and left the mutilated mollusk to its fate.

The ship was brought sufficiently near the Cuttle-fish to enable one of the officers to make a drawing of it. Its length was 15 or 18 feet ; and its eight arms, covered with suckers, were estimated at 5 or 6 feet long. Its eyes, flush with the surface of the head, were of enormous size, and their fixity is described as giving them a frightful aspect. The mouth, resembling the beak of a parrot, might be nearly 18 inches [in diameter]. The body was fusiform, much thickened in the centre, and its weight was estimated at 2000 kilogrammes (above 4000 lbs.). The fins formed two large, rounded, fleshy lobes.—*Comptes Rendus*, 30th December, 1861, p. 1263.

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XIX.—*On an apparently new Form of Holothuria.*

By JOHN ANDERSON, M.D.*

[Plate XI.]

IN the autumn of 1859 I dredged, from 5 fathoms of water in Bressay Sound, Shetland, the *Holothuria* which forms the subject of this memoir (Pl. XI. fig. 1). It was clinging to the inside of a dead and half-open *Modiola vulgaris*. When captured, it was of a cream-colour slightly speckled with brown; but since it has been in confinement, it has sensibly deepened in colour. During the first months of its imprisonment it was very lively, especially at night; during the day, when exposed to the light, it always contracted itself into a little ball, confining itself to one spot, and that the one exposed to sun-light. The tentacles were always exposed at night, but were immediately retracted whenever any attempt was made to examine them. About the beginning of the second month of its confinement it became more sluggish, and remained for days contracted, never displaying its tentacles even at night. The body contracted so firmly upon itself, that many of the feet by which it was attached gave way, and were left sticking to the sides of the glass vessel in which it was confined. After remaining in this condition for some time, the integument about the centre of the body at last ruptured, and through the opening a portion of the viscera were protruded, which ultimately sloughed away; at the same time a considerable portion of the external skin desquamated, the animal not appearing to suffer much from the process, for the opening healed shortly afterwards. The animal has been kept

* Communicated by the Author, having been read before the Royal Physical Society of Edinburgh, Jan. 22, 1862.

in a small shallow vessel of sea-water, with only a little piece of sea-weed in it to keep the water in good condition. During by far the greater part of the nineteen months of its confinement it remained contracted, seldom moving from one spot. The only food it could possibly have obtained must have consisted either of microscopic animalcules or the spores of Algæ. The animal is still alive; and I am therefore not in a position to say anything regarding its internal structure.

The dorsal region of the body, when the creature is contracted, is of a deep purplish-brown tint, but the ventral surface is of a paler hue. The dorsal surface, when the creature is distended, approaches very much to the colour of the ventral aspect when in a state of contraction.

When contracted, it is little more than a quarter of an inch in length, and about the fifth of an inch in breadth; but when distended and moving about, it becomes double this length, and its breadth also is slightly increased.

The five double rows of sucking-feet are unsymmetrical, the two dorsal rows being irregular in their distribution. The dorsal feet are much less numerous than the ventral, which they greatly exceed in size, and from which they differ very much in their undilated tips, and by their being seated in some instances upon rounded eminences or tubercles of considerable size. These feet are capable of complete retraction into the tubercles. Though the two dorsal rows of feet differ very much from the ordinary arrangement of these organs in the *Holothuriadæ*, we can nevertheless trace faint indications of the double character of the rows.

The three double rows of ventral sucking-feet are fully developed; the feet are placed opposite to one another, and are dilated at their tips, but are only partially retractile. The animal walks upon the three well-developed rows; and if turned upon the aborted ones, it immediately recovers itself, and turns round to what appears to be its ventral surface. In the anomalous genus *Psolus*, as is well known, the locomotive organs are restricted to a small flattened ventral disk, on which the three developed rows of feet are disposed.

The arrangement of the feet in the animal under consideration is another instance of a like specialization of function, and indicates the tripod nature of the *Holothuriæ*. Viewed thus, this little animal is fraught with interest, and may serve to connect, by its gradation of form, the genus *Holothuria*, with its five well-developed rows of locomotive feet, and the genus *Psolus*.

The tentacles (Pl. XI. fig. 2) are ten in number; eight of them

are long, pedunculated, and alternately branched; and the other two are short and divided at their tips. They are all of a palc-yellow colour, very pellucid, and are about a fifth of the length of the body when it is fully extended. The two short tentacles correspond to the two tuberculated rows of feet of the dorsal aspect.

The body of the animal is covered with calcareous plates of an irregular form, perforated by nearly circular apertures (fig. 4). The plates found in the feet of the three ventral rows (fig. 7) are spindle-shaped; but they change their form in the feet immediately surrounding the head (fig. 8), and become in appearance very similar to the plates found on the body-skin. The plates of the dorsal tubercles and feet (fig. 3) resemble in their irregularity the plates of the body of the animal; and the same may be said of the plates occurring in the tentacles (fig. 6), in which they may be found extending to their ultimate divisions.

The very delicate structure of the feet enabled me to examine them microscopically in the living animal; and when so examined, a continuous circulation of a minutely granular fluid may be seen, the current consisting of two streams—one passing along one side of the foot to the sucking-disk, and the other flowing back from this structure to the body of the animal.

This little creature evidently belongs to Linnæus's genus *Holothuria*, which Van der Hoeven has lately revived with the following signification:—

“Feet of twofold structure and figure, some cylindrical, dilated at the tip, usually occurring in the abdomen only, others situated on the back, not dilated at the tip, emerging from warts on the back. Body cylindrical or flattened in the abdomen.”

Having only found one specimen of this *Holothuria*, it would be premature, it appears to me, to describe it as a new species.

EXPLANATION OF PLATE XI.

Fig. 1. *Holothuria*, three times the natural size.

Fig. 2. Buccal extremity and tentacles.

Fig. 3. Calcareous plates of dorsal feet.

Fig. 4. “ “ body-skin.

Fig. 5. “ “ dorsal feet near head.

Fig. 6. “ “ oral tentacles.

Fig. 7. Portion of ventral foot, showing the form and arrangement of the plates.

Fig. 8. Calcareous plates from feet surrounding the head.

XX.—*Remarks on the Natural Order Bignoniaceæ.*

By BERTHOLD SEEMANN, Ph.D., F.L.S.

MR. MIERS, in concluding his "Observations on the Bignoniaceæ" in this Journal (ser. 3. vol. viii. p. 120), stated that having learnt my intention of continuing inquiries in that family, and wishing to avoid contravention, he had been induced to cede to me the priority, reserving, however, to himself the right of resuming the subject at a future time. I am fully sensible of the courtesy shown, but feel rather sorry, and I am sure the public will share my feeling, that Mr. Miers should, even for a time, have suspended his investigations of a natural order so much in need of a thorough revision, after having already thrown so much light upon it by a series of valuable observations and descriptions. The Bignoniaceæ have hitherto been handled so superficially by many authors, that even the labours of Don, Martius, DeCandolle, and Fenzl, important as they are, can scarcely be regarded as more than landmarks to guide us through a region of bewilderment and chaos, where there is room for more than one pair of eyes to observe, and more than one mind to draw conclusions.

It is not my intention to open my series of papers on the Bignoniaceæ by an elaborate criticism of Mr. Miers's "Observations on the Bignoniaceæ;" but as the result of his inquiries would seem to invalidate the characters upon which I and others maintained Crescentiaceæ and Bignoniaceæ as distinct orders, or, at all events, tribes, I am compelled to say a few words respecting them. The principal character dividing Crescentiaceæ from Bignoniaceæ proper is that the former have an indehiscent, the latter a dehiscent fruit. The genus *Tanaecium* I placed amongst Crescentiaceæ, because it is everywhere described as having an indehiscent fruit; and I had seen only flowering specimens of *T. albiflorum* and *T. crucigerum*, which form my first section; whilst of *T. lilacinum* and *T. parasiticum*, belonging to my second section (*Schlegelia*), I had seen, and in one instance eaten, the ripe fruit. Now, there are at the British Museum some loose fruit without any other remark save that they had come from Jamaica; and, though "these fruits are not accompanied by any dried specimen of the plant from which they were gathered," Mr. Miers referred them to *Tanaecium albiflorum*. I cannot admit the justice of this proceeding, and beg to recall to mind that by far the greater part of the confusion now existing in Bignoniaceæ has been caused by loose fruits and seeds being referred to plants with which they had nothing whatever to do. Mr. Miers has been led to form several erroneous conclusions by not being aware to what extent this has been done. For instance, when

he says that "in *Fridericia* the structure of the capsule and seeds completely agrees with that of *Jacaranda*," he was unaware that simply a genuine *Jacaranda* fruit had been figured with *Fridericia*,—a blunder made by Martius, but long ago rectified by Fenzl and DeCandolle. Again, when speaking of the fruit of *Spathodea campanulata*, he calls it, on the authority of a plate (t. 28) in Palisot de Beauvois, 'Fl. Owar.,' 4-celled, and "having numerous orbicular lentiform seeds with a narrow wing." The plate referred to represents a wretchedly drawn fruit, which we are told must either belong to *Spathodea campanulata* or *S. levis*; and, on the strength of this, Fenzl was tempted to remove *Spathodea* to *Crescentiaceæ*. But, as we now know the fruits of both those species, neither of which bear the slightest resemblance to that represented in the plate, we must look elsewhere, and have no difficulty in referring it to *Kigelia pinnata*—a plant very common in the whole region inhabited by the two *Spathodeas* named. Indeed, Mr. Miers was very nearly drifting towards the same conclusion, when his ready eye detected certain details agreeing with the figure of the fruit of *Kigelia* given in Delessert's 'Icones.'

Caution, and an ardent wish not to increase the existing confusion, compel me therefore to reject the assumption that the loose fruits preserved at the British Museum belong to *Tanaecium albiflorum*. They may belong to *Adenocalymna*, a genus of which nobody but Mr. Miers has seen the fruit. Should, however, at a future period, evidence be adduced that the fruits in question really belong to *Tanaecium albiflorum* and its nearest ally, I am quite prepared to admit the justice of separating generically my two sections of *Tanaecium*; but the materials at my disposal left no choice save that of combining them under one genus.

The belief that the fruit figured by Palisot de Beauvois belonged to *Spathodea*, instead of *Kigelia*, has led Mr. Miers into the further error of conjecturing the relationship of *Parmentiera* and *Spathodea*—two genera which agree in nothing save their spathaceous calyx. It is also a matter of regret that Mr. Miers assumed that I had copied my character of the genus *Parmentiera* from DeCandolle's account of the fruit of *P. edulis*, a description framed entirely upon the drawing and descriptions of Mocino and Hernandez. Mr. Miers forgets that I was the discoverer of the famous Candle-tree (*Parmentiera cerifera*, Seem.), and does not seem to know that I lived for some weeks in forests composed of it. The singularities of this strange production early attracted my notice, and I made numerous notes on the spot, which, with the specimens brought home, served as the basis of what I have written upon the subject. There is not the slightest tendency in the fruit towards becoming dehiscent and "evidently

2-valvular." The fruit, when fully ripe, simply enters upon a state of putrefaction. I must therefore object to the opinion that "the genus ought at once to be consigned to Bignoniaceæ." Mr. Miers is doubtful what part of the fruit is eaten by cattle. I stated that cattle, if fed with the fruit, soon get fat, and of course meant not a certain part, but the entire fruit.

If, then, all Crescentiaceæ have an indehiscent fruit, they must also have apterous seeds; for, as Lindley has justly remarked, no instance is known of the existence of winged seeds in indehiscent pericarps, as that would neutralize the object for which winged seeds seem to have been created. Yet Mr. Miers, again relying upon the correctness of figures when they are partly erroneous, assigns winged seeds to the Crescentiaceous genus *Colea*. "The several details," he says, "of *C. Mauritiana* (Bot. Mag. t. 2817), of *C. Telfairiæ* (ib. tab. 2976, and of *C. floribunda* (Bot. Reg. vol. xxvii. t. 19) all prove most distinctly the presence of a broad membranaceous wing around the seeds, as in *Bignonia*;" and "if," he continues in a foot-note, "the presence of a wing on the seed of *C. Telfairiæ* be questioned, there can no be doubt of its existence in *C. floribunda*." Neither the figure nor the description of *C. floribunda* in 'Bot. Reg.' vol. xxvii. t. 19 indicate the presence of a membranaceous wing; on the contrary, in that place, Lindley endorses the opinion that the division of Bignoniaceæ and Crescentiaceæ is founded upon important physiological and anatomical characters. With regard to the figure of *C. Mauritiana* in the 'Bot. Mag.,' it was taken from a drawing made abroad, by hands evidently not excelling in analyses; and in copying it again on stone, the lithographer, perhaps wishing to give greater distinctness to an obscurely drawn figure, may have made the seed appear almost winged. Bojer, who quotes this plate, and who had the plant growing in the Mauritius Garden, says most distinctly that, in common with *C. floribunda* and *Telfairiæ*, it has apterous seeds. It was also a positive mistake when, in a drawing of *Colea Telfairiæ*, transmitted to Sir W. J. Hooker and published in the 'Bot. Mag.,' a winged seed was introduced. This has been subsequently corrected; and in quoting t. 2976 of the 'Bot. Mag.' in my 'Synopsis Crescentiacearum,' I excluded fig. 2, as DeCandolle had done before me. *Colea Telfairiæ* has a fleshy indehiscent edible fruit, and is extensively cultivated in Madagascar, on account of its nutritious qualities and agreeable flavour. If it had a dry woody fruit like the Bignoniaceæ, how could it possibly be eaten? I therefore claim the genus *Colea*, on account of its indehiscent fruit and wingless seeds, as a genuine member of Crescentiaceæ. Besides, in most *Coleas* the flowers grow out of the trunk and old wood, which to my mind is perfectly convincing that the fruit is of more considerable

weight than the dry woody capsule of a Bignoniacea. The heaviest fruit borne by trees are always developed from flowers springing from the trunk and old wood. I instance *Crescentia*, *Theobroma*, the large-fruited *Myrtaceæ*. Mr. Miers occasionally witnessed the same mode of floral development in some species of *Tecoma*, "whose racemes grow out of the old leafless axils of the stem." I am well aware that several of the digitate *Tecomas* flower after all the leaves have fallen off, as, for instance, my *T. Guayacan* from Panama; but I have never seen blossoms on the trunk, or springing from the old wood, as happens in that section of *Colea* which I have termed "*Colea genuinæ*."

With regard to *Phyllarthron*, which Mr. Miers, notwithstanding the positive testimony of Bojer that it has an indehiscent fruit, also wished to expel from Crescentiaceæ, I obtained some additional information during my late visit to Mauritius. Mr. Duncan, of the Botanic Garden, showed me a drawing of the fruit of *P. Comorense*, made by his son years ago, according to which it is as fleshy and indehiscent as that of *Parmentiera*; and it is converted into sweetmeats in Mauritius. I regard it simply as a *lapsus pennæ* when Mr. Miers says that I stated *Tripinnaria* to belong to *Kigelia*, as I classed it with *Colea*.

It will therefore be seen that there is no reason why a good natural division should be set aside, and why any genus of Crescentiaceæ enumerated by me should be transferred to Bignoniaceæ. If *Adenocalymna* has really no wings, it would simply form an exception to the generality of Bignoniaceæ; and, in drawing up a diagnosis of the order, the word "*plerumque*" used in connexion with "*semina alata*" would remedy the difficulty. But unless I see the fruit actually *attached* to the specimens, I should hesitate to admit that *Adenocalymna* had wingless seeds. All the other genera having more or less apterous seeds require yet to be studied more closely. *Oxycladus*, Miers, which I think will prove to be identical with *Reyesia*, Clos, I could never bring myself to regard as *Bignoniaceous*; and *Henriquezia*, Benth., with its ally *Platycarpum*, H.B.K., by their semi-inferior ovary, five fertile stamens, and (in *Henriquezia*) stipulate leaves, would seem to be much better placed between Rubiaceæ and Loganiaceæ, forming a natural transition from one to the other. I have seen *Fagraeas* with a corolla much more irregular than that of *Henriquezia*.

As my principal object in this communication has been to vindicate the independence and integrity of the Crescentiaceæ as circumscribed in my Synopsis, I shall only touch slightly upon other statements made by Mr. Miers. *Dolichandra* is not marginicidal in its fruit, as Mr. Miers supposes; it is loculicidal, as stated by Chamisso, and must be classed with the *Catal-*

peæ and *Plœstictides*. The authentic specimens in Berlin leave no doubt on this point. It is a climber, the only *Catalpea* having tendrils! I do not consider *Bignonia glutinosa* a congener of it. That species is an erect shrub, and has a different calyx and corolla. Mr. Miers is quite right in referring *Delostoma* to *Catalpeæ*. After the publication of the fine plate of *Codazzia speciosa*, Karst. et Trian. (identified by me in 1859 with *Delostoma integrifolium*, Don), no one could doubt it. *Astianthus* ought also to be transferred to *Catalpeæ*, and placed near *Chilopsis*; *Cydistax* (*Yangua* Spruce, *Spathodea*? *fraxinifolia* H.B.K.) must share the same fate. *Tabebuia* I would not wish to keep up; most species enumerated under it by DeCandolle belong to *Tecoma* (which I restrict to the arboreous, digitate-leaved, monostictidaceous species), and the others to *Callichlamys*, *Bignonia*, and *Anemopægia* *. *Dipterosperma*, Hassk., I class with *Stereospermum* (*D. personatum* = *St. Hasskarli*, Zoll.). Several foreign elements I expel from the order altogether, viz. :—

Bignonia? *obovata*, Hook. et Arn. = *Stemmudenia pubescens*, Benth., an Apocynæa.

B. Peruviana, Linn. = *Vitis bipinnata*, Torr. et Gray, an Apeli-dea, according to an authentic specimen in the British Museum.

B. comosa, Roxb., may prove identical with *Paulownia imperialis*, or rather *P. tomentosa*, Ascherson (*B. tomentosa*, Thunb.), a Scrophularineæ.

Bravasia floribunda, DC. = *Onychacanthus Cumingianus*, Nees, an Acanthacea.

Spathodea ilicifolia, Seem. = *Digitalis dracocephaloides*, Arrab. Fl. Flum. vi. t. 101, an Acanthacea, but quite a new genus.

Tourretia lappacea, Willd., I would place amongst Sesameæ, near *Sesamopteris*, as Mr. Miers has already suggested.

For the present I shall content myself with these observations, necessarily forced upon me by what had been written after the publication of my 'Synopsis Crescentiacearum.' But as the public would not be in a fair position to judge of the merits of the case unless Mr. Miers's objections to the above were made known, I submitted the whole of the preceding matter to Mr. Miers; and the letter which he wrote to me after receiving it, and has kindly permitted to appear in these pages, will conclude all I have to offer :—

* *Tabebuia uliginosa*, T.? *leucoxylla*, *T. cassinoides*, *T. hemantha*, *T. triphylla*, *T. fluvialis*, and *T. rosea*, belong to *Tecoma*. *T. ilicifolia* is identical with *Bignonia anastomosans*, and probably the type of a new genus peculiar to Madagascar; *T. latifolia* and *T. ? rufinervis* belong to *Callichlamys*; *T. citrifolia* seems to be a species of *Anemopægia*; *T. pyramidata* is = *Zeyhera surinamensis*, Miq. (*Bignonia pyramidata*, Rich., *B. rupestris*, Gardn., *B. Sinclairi*, Bth., and a host of others).

"My dear Sir,

"Hammersmith, Feb. 13, 1862.

"I return your paper with many thanks for its perusal, and for your courtesy in sending it prior to its publication. You are perfectly justified in maintaining your former convictions in regard to *Tanaecium*, if you still believe in them; but I can hardly conceive, in the present state of science, how it is possible for any one to conclude that the *Tanaecium Jaroba*, Sw., and *T. parasiticum*, Sw., with such diametrically opposite characters, can belong to the same genus, or even to the same tribe. Putting aside for the moment the question of the fruit, we find that the structure of the ovary, seated on a peculiar disk, in the former, is quite that of *Adenocalymma* and of a few congeners, while that of *Schlegelia* has its ovules fixed in the middle of the dissepiment. In regard to the fruit which I described as that of *T. albiflorum*, it is true that it is^s not accompanied by any flowering specimen; but, coupled with the fact of the structure of the ovary, which I have fully verified, the evidence becomes almost complete; for the fruit in question agrees in size with Swartz's description in its singular oblong shape, its hard, smooth, 2-locular, 2-valved shell, with "many large, broad, compressed, imbricated seeds"—characters that scarcely leave a doubt as to its specific identity. This, again, is confirmed by the coincidence of flowering specimens of *T. prælongum* and fruit, both sent from British Guiana by Schomburgk*. The structure of the ovary, about which a doubt cannot be raised, shows the true position of *Tanaecium*, and proves incontestably that it cannot belong to *Crescentiæ*.

"With regard to *Parmentiera*, I regretted that you had not given more tangible characters of its fruit, and had not shown the structure of the ovary. I referred, in the absence of these, to your drawing, which marks, by two very distinct transversal lines, that the fruit is 2-valvular, no such sutural lines being found in *Crescentia*. I argued therefore that *if* these (your own) indications be confirmed, and *if* the ovary be found to be 2-locular, with ovules peculiarly placed, *then Parmentiera* ought to be referred to Bignoniaceæ. This would of course include *Catalpæ*, where it would go under certain conditions to be proved. I think you will not venture to gainsay so legitimate an inference. The characters to which you seem to attach so much importance—of flowers issuing from the trunk (also partial in other families), and of the edible fruit—are of no value in an *ordinal* point of view, whatever consideration they may deserve as *generic* attributes†. They would seem to show a close affinity between *Colea* and *Parmentiera*.

"What I mentioned about *Colea* was founded on the statements recorded up to that time by the best authorities; if those facts be erroneous according to the evidence you have since obtained at the Mauritius, you must deal fairly with the inferences previously drawn

* The fruit from British Guiana in the British Museum here alluded to is not accompanied by any herbarium specimens, though it is quite true that Schomburgk did send a *Tanaecium* in flower from that locality.—B. S.

† I did not say they possessed any *ordinal* value, but simply quoted them in proof of the fruit being fleshy and heavier than a mere dry capsule.—B. S.

and derived from the only legitimate sources at command. You admit that the figure of *C. Mauritiana* shows winged seeds. *C. Telfairiæ*, in 'Bot. Mag.' 2976, with a 2-valved fruit, is stated, on Bojer's authority, to have 'a spongy dissepiment bearing many seeds, which are surrounded by a thin and broad pellucid margin.' *C. floribunda*, which I have seen, had an unripe flattish capsule, very like that of a *Tecoma**. It will be gratifying to see any fresh evidence you can offer in regard to the structure of the ovary and fruit of *Colea*.

"I think it will be conceded by botanists that the only legitimate line of distinction between Crescentiaceæ and Bignoniaceæ exists in the former having a 1-locular ovary with parietal placentation (as I have seen in *Crescentia* and *Kigelia*), and a fruit with a solid sutureless shell, containing fleshy wingless seeds. In Bignoniaceæ we have a 2-locular ovary with ovules widely separated on the dissepiment, and a 2-celled, 2-valved fruit, generally, but not always, with winged seeds: it would be quite legitimate with this character (as in your *Parmentiera cerifera*) that the dissepiment should be large and cylindrical (as occurs also in *Stereospermum*), and that its valves should be prevented from bursting by a fleshy or coriaceous epicarp; for many capsules of true Bignoniæ are covered by a thick coriaceous envelope that keeps them from dehiscing for a long time after the fruit is ripe and has fallen. At all events, neither *Parmentiera* nor *Colea* can belong to Crescentiaceæ according to any legitimate line of demarcation. Crescentiaceæ, after the principle I have defined, form a very distinct group; but they cease to be so under your division, for you there break through the rule of carpellary arrangement, which forms the basis on which the grand system of Jussieu is founded. The Jacarandæ accord with Crescentiaceæ in their 1-celled ovary, with a parietal attachment of their ovules and seeds, but differ in having a dehiscent capsule with winged seeds. *Schlegelia*, from the construction of its ovary, will probably be found to belong to the group where my *Oxycladus* must find a place; for there can be no doubt, from the structure of its ovary, that it is a truly Bignoniaceous genus. I mentioned to you, after your return to England, that I had seen the fruit of *Fridericia*, and had convinced myself of the error of Martius, and had consequently erased the mistake from all the copies of my 'Observations' and 'Contributions;' and that ought to be considered a sufficient acknowledgment: it is enough to answer for our own mistakes, without being saddled with the errors of others. These observations are offered in the most friendly spirit, and may perhaps induce you to reconsider the matter before you publish your remarks. We have both the same object in view, which is to elicit the truth.

"I am, my dear Sir, very truly yours,

"JOHN MIERS."

22 Canonbury Square, London, N.

February 1862.

* As *Colea floribunda* flowers from the old wood, of course the leaves or flowers cannot be attached to this fruit; and hence it must be regarded as doubtful, or, at all events, as inconclusive.—B. S.

XXI.—Note on the Relationship of Cannabinaceæ.

By BERTHOLD SEEMANN, Ph.D., F.L.S.

It appears to be a growing conviction that the apetalous Exogens are not so intimately connected with each other as was formerly thought, but merely held together by the artificial character of not possessing perfect flowers, and that their relationship is to be sought rather amongst plants possessing both calyx and corolla than amongst those forms with which they have hitherto been associated. The number of apetalous orders kept systematically apart from petalous ones is constantly diminishing as the links connecting them with more highly developed types are discovered; nevertheless a good many still remain to be disposed of, and amongst them are the Cannabinaceæ, an order composed of three species, viz. *Cannabis sativa*, Linn., *Humulus Lupulus*, Linn., and *H. japonicus*, Sieb. et Zucc. Whilst fully admitting their intimate connexion with the Moreæ, Artocarpeæ, and Urticææ proper, they seem to present a number of characters proving them close allies of the Acerinæ and Malpighiaceæ. They agree with both in having opposite leaves, an imbricated calyx, suspended ovules, indehiscent fruit, exalbuminous seed, and convolute embryo. They share with Acerinæ the palmatinerved leaves and bifid stigma, with Malpighiaceæ the occasional climbing habit, hair affixed in the middle, stipules, paniculate flowers, solitary ovule, and superior radicle, showing the balance to be in favour of Malpighiaceæ. Without overrating habit, it is entitled to some weight. Whilst there is not a single winding Urticea, Artocarpea, or Morea, there are *two* winding Cannabinaceæ and a number of winding Malpighiaceæ. Hair affixed in the middle, so frequent amongst Malpighiaceæ, occurs in *Humulus japonicus*, but not in any other Urticaceous or other order of Dicotyledons, except Papilionaceæ (*Indigofera*). The presence of stipules and paniculate flowers is also important, whilst the solitary ovules and superior radicle are still more important considerations. The strong diclinous tendency and solitary carpels of Cannabinaceæ will probably be raised as objections to the view here ventilated, as being against the alliance with Endlicher's *Acera* and Lindley's *Sapindales*. It must, however, be remembered that polygamous flowers are common both in Acerinæ and Malpighiaceæ, whilst hermaphrodite ones are by no means rare in *Humulus* as well as in *Cannabis*. (Conf. Masters in 'Gardeners' Chronicle' and Regel's 'Parthenogenesis.') Nor do the solitary carpels present any difficulty. Petiveriaceæ, which do possess such solitary carpels, have already been ranged by Lindley between Sapindaceæ and Acerinæ. In fact, Lindley's diagnosis of Sapindales—"Hypogynous Exogens,

with monodichlamydeous unsymmetrical flowers, axile placentæ, an imbricated calyx and corolla, definite stamens, and little or no albumen"—virtually includes Cannabinaceæ, though placed by that author in a different alliance; and by adding to Endlicher's definition of his 'Acera' "carpidia interdum solitaria," the Cannabinaceæ are no longer excluded from them.

XXII.—*A Catalogue of the Zoophytes of South Devon and South Cornwall.* By the Rev. THOMAS HINCKS, B.A.

[Continued from p. 30.]

MEMBRANIPORA, De Blainville (*continued*).

13. *M. discreta*, n. sp. Pl. XII. fig. 1.

Cells oval, distant, distinct, varying in size, and irregularly disposed; the margin cut into about sixteen lobes, supporting as many spines, which bend over the aperture. Ovicell small, globose, minutely frosted.

On shell, from the Brixham trawl-boats.

In this species the cells are remarkably disconnected one from the other. They seem as if lying together in a group rather than united in one structure. They are also not uniform either in size or arrangement. The crenation or lobing of the margin is a very distinctive character. Each spine springs from a little boss on the edge of the cell.

LEPRALIA, Johnston.

1. *L. Brongniartii*, Audouin.

Very abundant from deep water, and also in moderate depths.

2. *L. Landsborovii*, Johnston.

Not common: Start Bay and from the Brixham trawlers, on shell; on *Sertularia abietina*, from 30 fathoms depth, coast of Cornwall.

[Abundant off the Great Orme's Head, North Wales.]

3. *L. reticulata*, Macgillivray.

Very common in deep water: one of the most abundant species on the Cornish *Pinna* from 60 fathoms, forming exquisite patches on the interior surface of the shell; on stone, from 40 fathoms; on *Eschara foliacea*, Devon, &c.

4. *L. auriculata*, Hassall.

Not rare: Torbay; on *Pinna*, 60 fathoms, &c.

[Off Maughold Head, Isle of Man.]

5. *L. concinna*, Busk.

Common: Torbay, on shell, forming large, circular, reddish patches; from 40 fathoms, a few miles south of Polperro, on stone, &c.

Mr. Busk gives the absence of spines as one of the distinctive marks of this species; two, however, are sometimes present on the fresher marginal cells, in sheltered situations.

[Very abundant on shells, &c., off the Isle of Man (north)].

6. *L. verrucosa*, Esper.

Devon, rare; near Polperro, on rock between tide-marks; on stone from 40 fathoms, Cornwall, a single specimen. "Coast of Cornwall, near low-water mark, and also in deep water" (C. W. Peach).

[Ilfracombe, between tide-marks.]

7. *L. violacea*, Johnston.

Not uncommon: on shell from the Brixham trawlers, forming a cream-coloured crust; Torbay, on shells.

8. *L. spinifera*, Johnston. Busk, Catalogue, pl. 76. figs. 2, 3.

Common on *Laminaria* stems and roots: Salcombe, &c.

The large interlacing roots of the Tangle are the home or hiding-place of a multitude of marine animals, and are generally rich in Zoophytes. The collector will always do well to "bag" as many of them as possible, and reserve them for quiet and close examination. The present species is very generally present, and I have seldom met with it in any other habitat.

[Isle of Man.]

9. *L. unicornis*, Johnston.

Very common on stones between tide-marks.

This is one of the most plentiful of the littoral species, often covering with its silvery-white crust very large spaces on the surface of rock or stone. I have never met with it except in the littoral region.

10. *L. ansata*, Johnston.

Rare: a few specimens only have occurred, on stones taken up from 40 and 30 fathoms depth off the Cornish coast. I have had the opportunity of examining the ovicell, which is not described by Johnston or Busk, and find that it differs widely from that of *L. unicornis*, yielding therefore another distinctive character. It is small, smooth, wanting the radiating grooves, and very intimately united to the cell above.

"On a slaty rock sent from Cornwall by C. W. Peach" (Johnston).

[On stone from deep water, off the coast of Antrim.]

11. *L. trispinosa*, Johnston.

Very common, on shell, stone, &c.: the 60-fathom *Pinnæ* are largely covered with its yellow crust.

12. *L. coccinea*, Abildgaard.

Common: Torquay, between tide-marks; Start Bay, Salcombe Bay, &c., Sidmouth (*Mrs. Gatty*).

13. *L. linearis*, Hassall.

Very abundant and generally distributed: plentiful in 60 and 40 fathoms depth, Cornwall; Torbay, &c.

This is decidedly one of the commonest species. It is usually of a pretty rose-colour.

[Isle of Man.]

14. *L. ciliata*, Pallas.

Very common: ranges from the shore to very deep water.

15. *L. Gattyæ*, Landsborough.

"Sidmouth, on *Phyllophora rubens*" (*Mrs. Gatty*).

16. *L. Woodiana*, Busk, Crag Polyzoa, p. 42, pl. 7.
figs. 1 & 3.

On the under surface of a large stone taken up from 30 fathoms, south-west of Polperro.

A single specimen only has been met with.

I have already recorded the discovery of this *Lepralia* off the coast of Antrim, where it occurs sparingly on shells from deep water. It is one of the species described by Mr. Busk from the Coralline Crag, and had only been known in a fossil state previous to its occurrence off the Irish coast. It has since been found at Madeira.

The Cornish specimen is in very fine condition, and enables me to correct a portion of Mr. Busk's description, which is inaccurate from his only having had the opportunity of examining fossil or worn examples. Instead of a "very minute *avicularium* on each side of the orifice on the highest part of the cell," *L. Woodiana* is furnished with two long and slender *vibracula*, which cross one another above the aperture. These organs have entirely disappeared in the Irish as well as in the Crag specimens, and their position is marked by two small openings.

The species is nearly allied to *L. Hyndmanni*, and appears to be essentially a deep-water form.

The Cornish agrees with the Madeiran specimens in the absence of the intercellular punctures.

17. *L. vulgaris*, Moll, Microscopical Journ. (Zoophytology, pl. 18. fig. 3).

Syn. *L. alba*, Hincks, Mic. Journ. (Zoophytology, pl. 30. fig. 2).

Abundant on stone from 30 fathoms, south-west of Polperro. In a paper published in the 'Proceedings of the Dublin University Zool. and Botan. Assoc.' vol. ii. pt. 1. p. 67, I have described a *Lepralia* under the name of *L. alba*. It was obtained by Mr. Hyndman, of Belfast, from deep water off the coast of Antrim. The Cornish stone which yielded the *L. Woodiana* has supplied me with abundant specimens of this form in the freshest condition; and I now find that I have fallen into the very error which I have just corrected in Mr. Busk's description of the preceding species, and have represented as avicularia what are in truth vibracular organs. But *Lepralia alba* with *vibracula* is plainly identical with the *L. vulgaris* of Moll—a common Mediterranean species, which has also been found at Madeira. My species must therefore be cancelled, and the *L. vulgaris* placed on our list in its stead. Thus is added another to the number of forms common to the Mediterranean and the British seas.

[Coast of Antrim, on shell.]

18. *L. variolosa*, Johnston.

Very common on shells and stones; abundant on *Pinnæ* from 60 fathoms: Brixham trawl-refuse; Start Bay, &c.

19. *L. nitida*, Fabricius.

Common, especially in the littoral zone: on stones between tide-marks: also on *Eschara foliacea* from 30 fathoms, &c. A favourite habitat is the surface of a fine Sponge which is found on rocks at Torquay, near low-water mark.

In the young state, the ribs present the appearance of sub-erect spines surrounding the margin of the cell; and the species bears the closest resemblance, as noted by Dr. Johnston, to one of the spiniferous *Membraniporæ*.

20. *L. Peachii*, Johnston.

Extremely abundant, from moderate depths to 60 fathoms.

21. *L. ventricosa*, Hassall.

Not uncommon: on stones from deep water, Cornwall, &c. Start Point (*J. S. Bowerbank*).

22. *L. innominata*, Couch.

Common: Torbay, abundant on shell; off Polperro, on stone from 40 & 30 fathoms depth, &c. Start Point (*J. S. Bowerbank*).

A beautiful variety is not uncommon from deep water, in which the central ridge is wanting, and along the furrows are set rows of punctures, which run continuously across the front of the cell. The texture is very delicate. This variety closely resembles the *L. radiata* of Moll. The chief difference is in the form of the avicularium, which in the latter species, as figured by Busk, Mic. Journ. (Zoophytol. pl. 20. figs. 4, 5), is of very great length, and blunt at the extremity.

[Isle of Man (north)].

23. *L. punctata*, Hassall.

Very common: on stones between tide-marks, and in moderate depths (Salcombe Bay); also on *Pecten* from the Brixham trawl-boats.

24. *L. Malusii*, Audouin.

Very common, on shells and stones; Torbay; Start Bay; abundant in deep water (60 and 30 fathoms) off the Cornish coast, &c.

25. *L. figularis*, Johnston.

On stones from deep water (40 and 30 fathoms) south-west of Polperro.

26. *L. pertusa*, Esper.

Very common, forming orange patches on shells and stones: Torbay; 40 fathoms, Cornish coast, &c.

27. *L. Pallasiana*, Moll.

Abundant between tide-marks, and in very moderate depths (Salcombe Bay); the predominant littoral species on the western coasts. The variety *armata*, figured by Mr. Busk in the 'Microscop. Journal' (Zoophytology, pl. 11. figs. 1, 2), has occurred at Torquay. The avicularium is only present on a few of the cells.

[Ramsay, Isle of Man; common.]

28. *L. labrosa*, Busk.

Not common: in a valve of *Cardium* from the Brixham trawl-boats; on *Pecten*, Start Bay.

[Isle of Man.]

29. *L. simplex*, Johnston.

I have met with one or two specimens in a shell from the trawl-boats.

Amongst deep-water dredgings from the coast of Antrim it is extremely abundant; and Mr. Hyndman has also obtained it off the opposite coast of Cantire. But, I believe, no other habitat has hitherto been recorded.

30. *L. Cecillii*, Audouin.

On a stone from deep water, coast of Cornwall; also on *Eschara cervicornis*.

This is an addition to our English list.

L. Cecillii had only been found till now in Jersey.

31. *L. adpressa*, Busk.

Torbay, on shells.

This is a very interesting addition to our fauna. The species was first obtained by Mr. Darwin at Chiloe, in 96 fathoms; and it has since been found abundantly on shells from Mazatlan. It will probably prove to be not uncommon on the Devonshire coast. I have already met with several specimens.

The Torbay examples agree with the Mazatlan form in the absence of the radiating grooves on the cells. The surface is granular. A blunt process is commonly present at each extremity of the lower margin of the aperture. The ovicells are small, somewhat depressed, closely adnate to the cell above, smooth in front, and strongly grooved round the border.

32. *L. bella*, Busk.

On shell from the Brixham trawlers; on a stone from 40 fathoms, south-west of Polperro.

33. *L. granifera*, Johnston.

Common, on stones between tide-marks and from deep water: Torquay, Salcombe (on red weed), &c. Sidmouth (*Mrs. Gatty*); coast of Cornwall (*Peach*).

Var. *cornuta*. On shell, Salcombe Bay.

34. *L. hyalina*, Linnæus.

Very common, on weed, stone, &c.

Polypide with twelve tentacles.

35. *L. fissa*, Busk.

On stones from deep water (40 and 30 fathoms), coast of Cornwall. "Coast of Devon (*Miss Cutler*); Exmouth (*Barlee*)."

36. *L. bispinosa*, Johnston.

Common, on stones and shells: Torbay (abundant), Salcombe Bay; Cornwall, from 30 fathoms.

Neither Dr. Johnston's description nor Mr. Busk's in the British Museum Catalogue does full justice to this species. It may be thus characterized:—

Cells ovate, elongate, minutely granular; orifice subquadrangular, two long spines on the upper margin, a strongly project-

ing mucro in the centre of the lower lip, from within the base of which a process springs, which bends to one side, and forms with the inferior margin a kind of loop; a denticle on each side of the mucro; on the front of the cell a raised avicularium with pointed mandible.

The species is liable to considerable variation. At times the mucro is much developed, and the surface of the polyzoarium bristles with the long spear-like processes. In other cases it is a mere tooth on the lower margin. The avicularia, which are generally very numerous, are occasionally wanting. *L. bispinosa* is very abundant in Torbay, and, when fresh, is of a delicate lilac colour.

37. *L. affinis*, n. sp. Pl. XII. fig. 2.

Cells broad-ovate, minutely punctured, separated by lines; orifice orbicular, with a raised peristome, produced below; three denticles within the inferior margin, of which the central one is the largest; on the lower edge an avicularium, placed transversely, with pointed mandible.

On shell from Start Bay.

This species bears a considerable resemblance in some respects to *L. Landsborovii*. The points of distinction are the shape of the cell, which is not elongate as in the normal *Landsborovii*, the smallness of the punctures, and their more irregular distribution, and especially the form and position of the avicularium.

38. *L. ochracea*, n. sp. Pl. XII. fig. 3.

Cells rhomboidal, separated by raised lines; surface reticulate, sometimes studded with prominent white granules; orifice orbicular, with a sinus on the inferior margin, a little below which is an oval avicularium, set somewhat obliquely, mandible pointing downwards,—sometimes replaced by a very large spatulate avicularium, extending to the bottom of the cell; ovicell —?

Colour of polyzoarium dull yellow.

On a stone from 30 fathoms, coast of Cornwall.

The oval avicularia vary considerably in size. In many of the cells they are replaced by the gigantic spatulate avicularia, whilst others are altogether destitute of these organs.

I have an Australian species, which is probably identical with this form.

39. *L. hastata*, n. sp. Pl. XII. figs. 4, 4a.

Cells oblong, disposed in radiating rows, and separated by narrow lines; surface smooth and shining, with rather large

punctures; orifice orbicular, with a slight contraction on each side below, four or five spines round the upper margin; immediately below the centre of the lower margin a mamillary process prolonged above into a spike, and on one side of it an avicularium with pointed mandible directed upwards; ovicell — ?

In a valve of *Cardium*, from Start Bay.

40. *L. armata*, n. sp. Pl. XII. fig. 5.

Cells ovate, somewhat ventricose, granular; orifice orbicular, with a loop below, enclosed by a raised border; four very long tapering spines, two of which are placed on the upper margin and two on the sides, the latter projecting in front of the ovicell; on one (or sometimes on each) side of the orifice a raised process, bearing on the summit a small round avicularium; ovicell wide, shallow, flat in front, smooth, or with a few raised lines. Large mounted avicularia, with elongate mandibles, scattered here and there amongst the cells.

On the under side of a stone, from 30 fathoms, south-west of Polperro, forming large brownish or grey patches.

[To be continued.]

XXIII.—*On the Fibrin and Latex of Vegetables, and on the Coagulation of Fibrin without Evolution of Ammonia*. By GEORGE GULLIVER, F.R.S., Professor of Comparative Anatomy and Physiology to the Royal College of Surgeons.

THE wide diffusion of fibrin through the animal kingdom is well known. But there is little notice, much less description, of a spontaneously coagulable fluid in plants. For instance, in the last edition of our most comprehensive work on human physiology, Dr. Carpenter says there is nothing in the juices of the plant analogous to the fibrin of the blood, and, further, that “the fact of the entire absence of any substance at all resembling fibrin in the vegetable juices, and the corresponding deficiency of the fibro-gelatinous tissues in their fabric,” may be added in confirmation of an ingenious view he had advanced: this refers to limiting the value of fibrin, as regards the ordinary nutritive processes, to the maintenance of the gelatinous tissues.

It is scarcely probable that the presence of fibrin in the vegetable juices can be unknown; for the fact is that fibrin is by no means uncommon in plants—that is to say, a fluid substance which will coagulate spontaneously at the temperature of the atmosphere, and then present an intimate structure of fibrils,

I have seen this fibrin in the clear juice of many fleshy roots ; but on the present occasion it will be described from observations on the latex, and from my notes of experiments on that of numerous species of the orders Papaveraceæ, Campanulaceæ, Compositæ, Convolvulaceæ, and Urticaceæ. These are only mentioned as examples ; for the facts to be described may be witnessed in other orders.

If the latex be let out of the plant, it will commonly coagulate quickly,—in less than four minutes, if in very small quantity, as may be seen in a drop, or less, on a slip of glass. In large quantities, as of several drachms, coagulation may or may not be slower. And that this coagulation is owing to the fibrin, previously a colourless and limpid fluid, may be easily shown, both during and after its coagulation. The coagulable property is probably affected by season and temperature ; for the juice of the very same plant, which will soon coagulate spontaneously in summer, frequently requires more time or fails altogether to do so in February and the cold months. The clot is often structureless, and sometimes composed of an intimate texture of fibrils. I have seen them closely resembling those of animal fibrin, long since depicted by me (App. to Gerber's 'Anatomy,' figs. 244–246 ; and Phil. Mag. for Aug. & Sept. 1842), but less closely packed, and so forming a looser tissue, such as we are familiar with in dilute or weak forms of human fibrin.

But this vegetable fluid differs remarkably from liquor sanguinis in being often coagulable by water. So rapid or instantaneous may the effect of water on the plant-fluid be, as to remind one of the action of corrosive sublimate on albumen generally, and of water on the albuminous substance of the ova of fishes particularly.

The colour and opacity of the latex, whether white or yellow, is generally due to particles of extreme minuteness, about $\frac{1}{30000}$ English inch in diameter. These are very equal in size, form the base of the juice, and altogether closely resemble the molecular base of the chyle of Mammalia, as originally described and figured in my Appendix to Gerber's 'Anatomy.' This molecular base, with certain exceptions presently to be noticed, is the whole opake matter visible in the vegetable latex ; and the limpid fluid containing the fibrin and this molecular base are quite different parts. These parts might be respectively distinguished as the molecular base and liquor laticis.

But the milkiness or opacity of the latex of some plants, as in certain Convolvulaceæ, Cynarocephalæ, and Urticaceæ, is not owing to this molecular base, but to larger oil-like globules, of very unequal size and distinct outline. In *Convolvulus*, these globules vary from $\frac{1}{24000}$ to $\frac{1}{3000}$ inch ; in the garden Fig they

are larger and more distinct still; and of intermediate size in some species of *Carduus*.

Again, in other plants the molecular base may be present in the latex, and the fibrin quite absent, while another matter appears. This may be well observed in some Euphorbiaceæ. Thus in *Euphorbia Lathyris* and *E. Peplus* the latex will often not, and perhaps never will, coagulate spontaneously, and is little affected by the addition of water, while the latex of *E. exigua* is quickly coagulated by water. The liquor laticis and the molecular base giving opacity to the latex certainly exist together in Euphorbiaceæ. But the most remarkable objects in this juice are staff-like bodies, about $\frac{1}{800}$ inch long and $\frac{1}{6400}$ thick. These measurements were obtained in *E. Lathyris*; but they differ considerably in different species, and the objects are either swollen in the centre, like a rolling-pin, or without any such swelling, like a rod. I have examined most of the British species of this genus, and never found these staff-like bodies absent. By iodine they are instantly made much more distinct, and of a very dark-blue colour, while the molecular base and its fluid are only tinged yellow. Hence they would appear to be a form of starch, and might be called starch-sticks; and by them alone the latex of Euphorbiaceæ is very easily and certainly distinguishable from that of other orders of plants*.

The precise use of the vegetable latex is mere matter of conjecture. If, as Dr. Lindley reports ('Elements of Botany, Structural, Physiological, and Medical,' p. 9), it be conveyed to the newly formed organs, we may well suppose it, like the chyle of the highest animals, to be a provision for growth and nutrition, especially now it is shown how commonly the latex is composed of the molecular base and of either fibrin or starch, independently of whatever albumen may coexist with these.

Two hypotheses as to the origin of fibrin have been current in our day:—the first, entertained more than a century since by Sydenham, Quesnay, and Bordenave (Introduction, pp. xxvii.—xxviii., to the Sydenham Soc. edition of Hewson's Works), and revived subsequently, that the fibrin is formed at the expense of the red corpuscles of the blood; the other, very recently popular, that the fibrin is produced by the agency of the pale globules. But now we find this vegetable fibrin certainly without any free or floating cells at all.

There are two other points of view in which the characters

* Since the above was printed, I find that these bodies have been well described in Euphorbiaceæ by Schultz and others. The late Mr. Quekett figured them, like two-headed clubs, in *E. splendens*.

or properties of the latex appear interesting:—first, that the plant-juices may afford some help to classification; and secondly, as regards the most recent doctrine as to the cause of the coagulation of the blood. Thus we have seen a very characteristic and plain fact in the latex of Euphorbiaceæ. Nor is it any longer doubtful that a mere microscopic part may show the difference, even more generally than any one single and large character whatever, between two great divisions of the animal kingdom. For, since the publication of my observations, in the Appendix to the English version of Gerber's 'Anatomy,' it has become generally admitted that the presence or not of the nucleus in the red corpuscle of the blood of Vertebrata is a true difference between Mammalia and the three lower classes, and that this simple character is applicable to all ages, sexes, and conditions—of course excluding that early period of intra-uterine life when, as I have long since shown, the temporary red corpuscle of Mammalia is the true analogue of the permanent red corpuscle of oviparous Vertebrata. And, to revert to the vegetable latex, Mr. Babington, who has so much advanced our knowledge of British botany, has already adopted specific characters derived from the colour of the juice in the genus *Papaver*.

As to the cause of the coagulation of the blood, any theory that does not include the fibrin of other parts is not likely to prove satisfactory. Dr. Richardson, in his elaborate and valuable work, assigns as the cause for that coagulation the evolution of the volatile alkali; and I believe his view already passes current in some of our systematic treatises. Now, I have tested these vegetable juices so often, and always in vain, for ammoniacal vapour, that I believe the fibrin in them coagulates quite independently of any evolution of ammonia. Besides the microscopic test, so much insisted on by Dr. Richardson, other trials were made, like those described by Dr. Davy (and with the same negative results) in his examination of coagulating blood. And so I found, too, in spontaneously coagulable mixtures of serum; no evolution of even a trace of ammonia could be detected during the coagulation. These observations are not adduced as conclusive against this chemical view of the cause of the coagulation of the blood, but merely as examples of the obstructions which at present lie in the way of a free admission of that view.

Edenbridge, Jan. 31, 1862.

XXIV.—*On the Investigation of Microscopic Forms by means of the Images which they furnish of External Objects; with some Practical Applications.* By Prof. O. N. ROOD, of Troy, N.Y.*

It would hardly occur to a physicist, who was requested to determine whether a certain disk of glass was a convex or a concave lens of slight curvature, to attempt a solution of the question by glancing along the two sides; on the other hand, neglecting even to look at the glass, he would at once bestow his undivided attention upon the *images* of external objects formed by it, and thus with ease and certainty decide upon the nature, degree, and regularity of its curvature.

The simple idea here enunciated seems hardly to have been applied to the study of microscopic forms, though, from some experiments lately made in this direction, I am firmly convinced that this method of determination is destined hereafter to play a most important part in microscopical observation. To the microscopist it will prove as powerful a means of investigation as it now is in the hands of the optician.

The most convenient and effective mode of proceeding in this case which has occurred to me is the following:—The microscope is brought into a horizontal position, the mirror removed, and the illumination supplied by a candle or lamp placed in the axis of the compound body at a distance of not more than three inches from the stage. If now a small sphere of glass be properly supported on the stage, it forms behind itself a very minute inverted image of the flame of the candle; upon drawing back the compound body slightly, this image comes into focus, and is seen of course in an erect position. When a rod of $\frac{1}{10}$ th of an inch in thickness is moved up and down between the flame and the globe, an image of it is seen in the microscope with great distinctness, and it is observed that the motion of this image follows in all respects the motion of the hand. Upon replacing the sphere by a minute concave lens, as an air-bubble in water, the reverse takes place; to gain distinct vision of the flame, it becomes necessary to move the compound body within the focus; the image of the flame is seen to be inverted, and, what is practically more important, the motion of the rod seems reversed. It will happen very generally, in applying this method, that the image of the flame is not sufficiently perfect to decide whether it is erect or inverted; the *motion of the rod* then furnishes us with a certain means of deciding this point: if its motion is natural, the image is erect, and the curvature convex, &c. After some practice, it becomes easy to obtain the best focal adjustment for distinct vision of the rod, and in extreme cases where the image is very

* From Silliman's 'American Journal of Science,' &c., Jan. 1862.

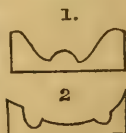
badly defined, the focal adjustment is best made while the rod is in gentle motion. I now adduce one or two applications of this method.

Examination of the nature of the Markings on the Coscinodiscus, Triceratium, &c.

It is well known among microscopists that the controversy regarding the nature of the marking on these shells, after being carried on for several years with spirit, cannot even yet be considered as settled,—one party contending that the areolæ are depressions, while their antagonists see them as elevations. Compare Carpenter 'On the Microscope,' page 280, American edition.

Fine specimens of these shells mounted in water were examined by a power of from 600 to 800 diameters; on moving the compound body within the focus, each hexagon was found to contain a small distinct image of the flame; the motion of the rod showed that the images were inverted, and consequently formed by *concave lenses*. As the index of the refraction of water is much less than that of silica, its effect is merely to diminish the action of the curved surfaces, but in no case to reverse it. These shells were now mounted in Canada balsam and observed. As the index of refraction of the balsam is somewhat greater than that of silica, it was to be expected that in the compound lenses of silica and balsam the latter would predominate, and reverse the action, so as to present effects due to convex lenses. This was found to be the case, and in some of the valves the eye could readily follow, in a hundred areolæ at a time, each flickering motion of the flame as it was stirred by the wind. The valves, when mounted in balsam of tolu, which has a still higher index of refraction, gave like results. These experiments, which are not difficult to repeat, prove that the areolæ are well-formed *concave lenses*.

A similar mode of experimenting, which must be conducted on large valves, and with some delicacy, shows that the border or setting, so to speak, has the opposite curvature, viz. is convex; whether it is convex as a cylinder, or beset with several convex markings, I have not had leisure to determine, though in some large specimens the latter seemed to be the case. Indications also were observed in some large specimens that would lead to the deduction of a form optically equivalent to that seen in fig. 1; and certain allied forms readily furnished the curve seen in fig. 2, the small depressions being pits.



This mode of experimenting often furnishes us the means of determining whether certain appearances are really due to open-

ings or to some other cause. Thus the small circles at the middle and ends of the *Pinnularia viridis* have been mistaken by some eminent observers for openings. Prof. Bailey proved, by the action of hydrofluoric acid, that they are in reality thicker portions of the shell; and examination by the method here described shows that they are convex lenses, giving often very well-defined images of the flame. The dots characterizing the *Coniferæ* furnish images of the flame indicating two or more curvatures; the ribs of the *Pinnularia* and the spaces between them have opposite curvatures, &c. But the examples already given may be sufficient to show the usefulness of the proposed method.

Index of Refraction of the Silica composing the Valves of the Diatoms.

This point is closely connected with the foregoing; and it may not be amiss to detail a few experiments that were made to determine it.

Although Canada balsam has the same index of refraction as quartz, still the valves of the Diatoms which are composed of silica are seen almost as distinctly in balsam as when mounted in water.

To ascertain the relation between the index of refraction of quartz and Canada balsam independently of optical tables or laborious experiment, I combined a convex quartz lens, of one-inch focus, cut at right angles to the optic axis, with unheated fluid balsam placed on a glass slide; the two opposite refractions balanced each other so perfectly, that the combination acted like a plate of glass with plane parallel sides, and, with ordinary means, I was at a loss to discover any tendency to convexity or concavity. Balsam which had been heated was now combined with the quartz lens in the same manner: the balsam proved to have gained in refractive power, so that the combination now acted distinctly as a concave lens of weak curvature.

Diatoms were then mounted in this unheated fluid balsam, in which properly they should have been invisible, owing to the coincidence of refractive indices; but, as had been anticipated, they appeared beautifully, though perversely, distinct. A casual remark from Alex. S. Johnson, Esq., concerning a certain chemical difference he had often noticed between ordinary silica and that composing the Diatom-valve, again turned my attention to this point. Experiments were made upon a sample of the Rappahannock infusorial earth, which had been given to me by Prof. Wm. B. Rogers, in its natural state. By immersing the valves in various liquids, I finally ascertained that in strong sulphuric acid they became either *invisible* or very nearly so, while the grains of sand on the slide retained their distinctness

perfectly. It was curious to observe how, by diluting the acid with water, the valves again became visible and distinct in outline markings. By igniting this earth I produced a slight change in the index of refraction of the silica composing the valves, so that afterwards they were visible with tolerable distinctness in the same sample of sulphuric acid.

Index of refraction of	water		1.336
"	"	sulphuric acid	 1.435
"	"	Diatoms	 1.435
"	"	quartz	 1.548
"	"	Canada balsam	 1.548

This table shows that the index of refraction of the Diatoms is about half-way between that of water and Canada balsam, thus explaining the fact that they appear about equally distinct in both of these media.

XXV.—On *Ætotoxicum* and *Bursinopetalum*.

By JOHN MIERS, F.R.S., F.L.S. &c.

ÆTOTOXICUM.

THE position of this genus of the Flora Peruviana has not yet been satisfactorily established; but the observations I have been enabled to make will probably throw some light on the subject. The only botanist who has suggested a place for it is Sir Wm. Hooker, who, in 1837, referred it to *Euphorbiaceæ*; but the structure of the fruit and seed, with other characters, militate against this conclusion. Notwithstanding the anomaly of some of its features, the weight of the evidence here collected together will, I think, show its close proximity to the *Aquifoliaceæ*. The distinguished botanist just mentioned, when he described its flowers as being diœcious, had only seen the male plant; they are, however, properly speaking, polygamo-diœcious: that is to say, in the male flowers the ovary, though present, is rudimentary and sterile; and in the female flower, although the stamens of the usual size exist, the anther-cells are abortive and deficient of pollen: the two sexes are always in distinct plants, and in all these respects the genus resembles *Prinos* and *Nemopanthes*: so far, therefore, *Ætotoxicum* is quite reconcileable with the *Aquifoliaceæ*. Its only known species is a native of the central and southern provinces of Chile, where it forms an evergreen tree of some height, with oblong alternate leaves, covered with lepidote scales. Its flowers are small, in simple axillary racemes much shorter than the leaves, the whole inflorescence being densely covered with lepidote scales similar to those of the leaves. Each flower, while in bud, is closely invested by a membrana-

aceous entire spherical bract, which bursts by laceration from the base, and falls off to allow of the expansion of the floral parts: we find no other genus in the family possessed of this character. The calyx consists of five (rarely six) orbicular concave membranaceous sepals, which are much imbricated in æstivation, and are formed of close rows of longitudinal cells, all radiating towards the circumference from the point of attachment; and they therefore easily split in that direction. The petals, always equal in number to the sepals, are alternate with them; they are longer, obovate, narrowed towards the base, with an internal raised keel and undulating crispate margins; in the female plant they are quincuncially imbricated in æstivation; in the male flower the three internal petals have their apices much inflected and plicated together,—in all which respects they closely resemble those of *Villaresia*. The stamens, in both sexes, usually five (rarely six), alternate with the petals and with as many fleshy glandular processes, all being hypogynous around the ovary. Whenever the flower is abnormally 6-merous, the sixth sepal, petal, stamen, and gland are always smaller, sometimes almost rudimentary; and in all cases these are forced out of the concentric serial lines by crowding, so that the perfect symmetry of the parts becomes thus somewhat deranged, showing the normal structure to be 5-merous, and that it only becomes 6-merous by a kind of monstrous growth. In order to ascertain the nature of the glandular processes, it is necessary to particularize their structure. They are described by Sir Wm. Hooker as a nectary,—a term too ambiguous in its meaning; they appear to me sterile stamens, or staminodes; for they alternate with the filaments, and seem to stand in the same whorl; they are somewhat deltoid in form in the ♂, tapering downward to the point of their attachment round the base of the small central sterile ovary, are almost unequally 2-lipped and slightly concave at the summit, each lip being emarginated; from their form, they appear somewhat radiately expanded, and, as well as the stamens, are quite glabrous, leaving in the centre the depressed disk-shaped ovary, which is covered with lepidote scales, similar to those which invest the bract and leaves. These staminodes, in the ♀ flower, are more compressed, simply 2-lobed in the summit, and, like the stamens, stand erect, pressed against the ovary; they cannot be considered as the lobes of a disk, because they are perfectly free and hypogynously attached, alternating with the stamens round the base of the ovary.

The filaments in the ♂ flowers are semiterete, thick, and fleshy, divaricating outwards at the point of their hypogynous attachment, but gradually curve inwards, so that the anthers meet in a connate form in the centre: the anthers are nearly globular,

and, consisting of two adnate lobes, are cordate at the base, where they are somewhat dorsally affixed to the pointed apex of the filament; the lobes burst somewhat laterally, each by a longitudinal fissure, the margins of which contract, so that each appears to open by a large broad pore; they are nearly the length of the filament, the entire stamens being twice as long as the intermediate staminodes, the same length as the sepals, and two-thirds the length of the petals. Sir Wm. Hooker's figures of the parts of the male flower are very correctly depicted.

In the female flower, the bract, sepals, and petals are similar to the same parts in the male; but the petals in the bud are pressed imbricatively upon the ovary, which fills all the space in the centre. The five filaments are linear, half the length of the ovary, against which they stand erect, are much compressed and rendered somewhat emarginate at the summit by the presence internally of two small yellow glands, which are the abortive anthers: the five alternate staminodes are rather more than half their length, nearly double their breadth, emarginate at the summit, equally compressed and erect, and stand in the same whorl hypogynously attached round the base of the ovary: they are all quite smooth; but the ovary is densely covered with imbricated peltate lepidote scales, entirely concealing the style, which is suddenly bent down and adpressed upon it: when the flower bursts, the style raises itself out of its imprisonment and remains still considerably reflexed; it is smooth, terete, and about one-third the length of the ovary, being terminated by a somewhat compressed 2-furcate stigma, the forks of which are rather acute. The ovary is 1-celled, with two ovules suspended from near the summit, affixed by a small point to the apex of an internal longitudinal ridge, nearly as in *Villaresia*, which ridge is probably formed of four abortive cells. This becomes developed into an oval dry drupe, about 5 lines long and 3 lines in diameter, consisting of a somewhat chartaceous indehiscent 1-celled putamen, marked internally and externally by the line indicating the suppressed axis, from the summit of which two seeds are suspended, filling the cavity of the cell: each seed is therefore oval and plano-convex; its integuments are membranaceous, with a small basal chalaza: the enclosed nucleus is a fleshy albumen, imbedding in its summit an embryo of half its length, with cordiform, broadly ovate, acute, foliaceous cotyledons, and a terete subulate radicle, equal to them in length, with its thicker extremity nearly touching the superior hilar point of attachment of the seed.

There may be seen in all these details the very closest resemblance to the structure of *Villaresia*, the chief points of dissimilitude being the presence of the singular floral bract and of the

five staminodes. To the former, little importance can be attached in an ordinal point of view. This organ is very analogous to the involucreal calycul of the *Chamælaucieæ*, and, like it, breaks away from the base to allow of the opening of the flower. With respect to the nectarial glands, they must be regarded either as portions of a disk, or (as just assumed) as sterile stamens (staminodes); we cannot admit the first hypothesis, because these processes do not support the ovary, but are quite free, hypogynous, and alternate with the stamens in the same whorl: the natural conclusion, therefore, is that they are metamorphosed abortive stamens, or *staminodia*. We must bear in mind that, throughout the *Aquifoliaceæ*, there is a general tendency to the suppression or depauperation of some of the floral parts, by which the flower becomes more or less polygamo-dioecious. To this reasoning it may be objected that hitherto the rule has been universal in the *Aquifoliaceæ* for the stamens to be equal in number to the petals; but many other families could be adduced where, although such is the prevailing rule, exceptions (solitary or few) occur, where the number is double; the occasional existence of a set of staminodes, in addition to the usual number of stamens, is not unfrequent in families remarkable for their isomeric proportions; and under this point of view we may be justified in admitting *Ætotoxicum* within the limits of the *Aquifoliaceæ*. But if it be thought desirable in order to preserve the consistency of the family, this genus might form the type of a distinct subtribe (*Ætotoxicæ*) distinguished from the tribe *Ilicineæ* by the peculiarities before described. In support of this view we may add that *Chailletia* has similarly-shaped staminodes, placed in like manner in the same whorl alternately with the stamens. Similar processes appear to exist in *Siphonodon*, Griff., a genus referred to *Aquifoliaceæ*.

From the analytical details before given, I now offer the following amended generic character:—

ÆTOXICUM, R. & P.—*Flores* dioico-polygami. *Masc.* in diversa planta. *Bracteola* membranacea, in calyptram undique clausam cum pedicello continuam florem involucrans, dense lepidota, e basi demum irregulariter rupta, et hoc modo decidua. *Sepala* 5 (rarissime 6), orbicularia, concava, membranacea, glaberrima, in æstivatione valde imbricata. *Petalata* 5 (rarissime 6), spathulato-oblonga, apice obtusa, imo angustiora, intus carina longitudinali prominente extusque nervo instructa, margine crenulato-crispata, æstivatione quincuncialiter imbricata, apicibus introflexis et inter se plicatis. *Stamina* 5 (rarissime cum sexto rudimentario), petalis alterna et breviora, introrsa; *filamenta* semiteretia, incurva, carnosula,

circa ovarium sterile depressum inserta: *antheræ* conniventes, subglobosæ, basi cordatæ, dorso affixæ, 2-lobæ, lobis adjunctis, subcoriaceis, utrinque rima obliqua demum poriformi lateraliter dehiscentibus. *Staminodia* 5 (rarissime 6), staminibus alternantia, et cum iis hypogyna, carnosula, cuneatim subdeltoidea, summo sub-bilabiata, labiis emarginatis, erecto-patentia, glaberrima. *Ovarium* rudimentarium, discum parvum depressum subplanum mentiens, *stylo* obsoleto mammæformi notatum, dense lepidotum.—*Fœm.* *Bracteola*, *sepala*, et *petala* maris. *Stamina* 5, sterilia, hypogyna, ovario adpressa, persistentia; *filamenta* linearia, compressa, erecta, imo paulo curvata, apice obtusatim emarginata, intus glandulis 2 polline destitutis apiculata. *Staminodia* 5, cum staminibus alternatim hypogyna, iis dimidio breviora, et duplo latiora, erecta, compressa, extus sulco notata, apice emarginata, persistentia. *Ovarium* ovatum, subgibbum, petalis paulo brevius, crebriter lepidotum, 1-loculare; *ovula* 2, collateralia, summo lineæ parietalis prominentis suspensa. *Stylus* subtenuis, teres, glaber, ovarii tertia parte longitudinis, valde deflexus. *Stigma* breviter 2-furcatum, furcis acutis. *Drupa* exsueca, inversim obovata, sublepidota, stylo marcido apiculata: *putamen*, coriaceo-chartaceum, 1-loculare, 2-spermum. *Semina* plano-convexa, ex apice pendula; *integumenta* membranacea, imo *chalaza* parva signata. *Embryo* in summo albuminis carnosus et ejus dimidio longitudine immersus; *cotyledonibus* foliaceis, subdeltoideo-cordatis; *radicula* tereti, subulata, subæquilonga, summo spectante.

Arbor Chilensis: folia alterna aut subopposita, oblonga, supra glabra, subtus lepidota, breviter petiolata, exstipulata; racemi axillares, folio breviores, leproso-lepidoti: flores parvi.

1. *Ætotoxicum punctatum*, R. & P. Syst. Veg. Per. p. 260; Prodr. Flor. Per. et Chil. p. 131, tab. 21; Hook. Icon. i. tab. 12; Gay, Chile, v. 348;—ramulis teretibus, griseo-opacis, nigro-punctulatis, junioribus rufescentibus; foliis subalternis vel oppositis, oblongis, utrinque subacutis, aut obtusis, subcoriaceis, supra in junioribus sparsim lepidotis, in adultis glabris, subtus e squamulis peltatis, radiatim nervosis, margine ciliatis dense griseo-furfuraceis et ferrugineo-lepidotis; petiolo brevi; racemis simplicibus, axillaribus, folio paulo brevioribus, floribus parvis.—Chile, v. s. in herb. meo et aliorum c. Quillota (Bridges, 505); Cauquenes; Concepcion (Macrae et Harvey); Valdivia (Bridges, 558): Chile (Cuming) ♂; Maule (Germain) ♀.

A tree of moderate size, growing sometimes to the height of 40 feet, found in most of the central and southern provinces of

Chile, where it is known by the several names of *Aceytunillo*, *Palo muerto*, and *Téque* or *Téke*. Its leaves are 3 inches long, $\frac{3}{4}$ – $1\frac{1}{4}$ inch broad, on a petiole of 3 lines; the axillary racemes are 1 inch long; the pedicels $1\frac{1}{2}$ line, the flower in bud $1\frac{1}{4}$ line, the flower expanded $3\frac{1}{2}$ lines diameter; the sepals $\frac{1}{2}$ line diam.; the petals 2 lines long: the female raceme is shorter (3–6 lines long), with flowers similar in size to those of the ♂; the drupe is 4 lines long, 3 lines diameter*.

BURSINOPETALUM.

More than ten years ago, in alluding to the structure of this genus†, I suggested that its characters were more in accordance with the *Aquifoliaceæ* than with *Olacaceæ*, to which family it had been referred. Since then (in 1855) Mr. Thwaites published an interesting note‡, in which he stated that he had examined living specimens, which led him to the conclusion that its real affinity was with *Araliaceæ*, pointing out the resemblance of its flowers to those of *Hedera*. I have recently repeated carefully my former investigation, and am again struck with the many points of resemblance it offers to the structure of *Villaresia*. One of these characters—the imbricate æstivation of the corolla—has been denied by Mr. Thwaites, who states that, after examining the flowers of *Bursinopetalum* in the living state, he is convinced that it is valvate. It appears to me, however, that he has drawn this conclusion too hastily. I have observed, in the flowers of *B. arboreum*, which are 5-merous, that the margins of the petals distinctly overlap each other quincuncially, not to any very great extent, it is true, but sufficiently so to render the fact incontestable; besides which, the apices of the petals are at the same time deeply inflected (as in *Stemonurus*); but, owing to the manner in which these inflected portions are held together by their imbricated plicature, I have found, in attempting to unravel the bud, that the petals do not open, because the whole corolla falls off in a cupular form with a slight touch. If the petals in this state be spread out radially when held together (as just stated) by their apical plicature in the centre, the quincuncial character of its æstivation then becomes palpably evident. I have seen the flower of *Bursinopetalum tetrandrum* only in bud, where I found the apices of the four petals overlapping each other in the apex, the more interior petal being opposite to the more exterior: this I could not unravel, as the petals adhered together so forcibly as to resist the attempt to separate them; but on

* This plant, with full analytical details, will be figured in the 'Contributions,' vol. ii. Plate 72.

† Ann. Nat. Hist. 2 ser. viii. 169; Contributions to Botany, i. 29.

‡ Hook. Kew Journ. Bot. vii. 242.

making a cross-section, I observed that, at the junction of the petals, the margins were not square and valvate, but were all considerably inclined, their chamfered edges overlapping each other in a direction corresponding to the indications seen at the apex. The extent of this overfolding in the latter species (which is the one mentioned by Mr. Thwaites) is small, so that under a hasty examination it might be mistaken for a valvate junction of the margins; in the former species, the imbricate overlapping of the edges is so considerable as to admit of no doubt.

In the general habit of *Bursinopetalum*, in the form of its simple leaves and simple joints, there is nothing to show any approach to the *Araliaceæ*: its inflorescence is always in a trichotomous panicle, not umbellate as in that family; the ovary is only half inferior, and always unilocular, with a single suspended ovule: in these respects, as well as in the æstivation of the corolla, *Bursinopetalum* is irreconcilable with *Araliaceæ*. On the other hand, the form of its calyx, its five petals imbricated in æstivation, deeply inflexed at the apex, and with an internal carinated nervure—its five alternate stamens rising from the margin of the ovary, with subulate filaments spreading towards the base—a one-celled ovary, with an ovule suspended from a longitudinal parietal expansion of the placenta—a simple style—a dry 1-locular drupe, with a coriaceous indehiscent putamen, enclosing a single seed that fills its cavity and is moulded in a horse-shoe form round the longitudinal parietal expansion, which extends nearly to the centre of the cell—a fleshy albumen, enclosing in its summit an embryo with a superior terete radicle—are all characters surprisingly in accordance with *Villaresia*, the principal point of its disagreement being its inferior fruit. With this single exception, *Bursinopetalum* is quite conformable with the *Aquifoliaceæ*; and even this exception, making due allowance for its aberrance, in great measure may be reconciled. The ovary, with its fleshy summit assuming the appearance of an epigynous disk, as in *Styracææ*, is half superior, that is to say, its cell rises above the level of the insertion of the stamens; and we find a parallel of this instance in *Halesia*. I have shown how it happens in that genus*, contrary to what occurs in *Styrax* and its congeners, that the superior moiety of the ovary remains almost unchanged, while the principal growth takes place in the lower moiety, from which it results that a half-superior ovary becomes converted into an inferior fruit. Now, precisely the same occurrence takes place in *Bursinopetalum*; and if on this account we were to deny its right to rank in *Aquifoliaceæ*, then, for the same reason, we ought to exclude *Halesia* from the *Styracææ*, which few would venture to propose. For the same reason

* Ann. Nat. Hist. 3 ser. iii. 137; Contributions to Botany, i. 168.

that the *Halesiæ* have been made a tribe of the *Styracæ*, *Bursinopetaleæ* may be considered a second tribe of the *Aquifoliaceæ*, the *Ilicineæ* being the first.

I will add, in justice to Mr. Thwaites, that three years subsequently to his note before mentioned, in his 'Enumeration of Ceylon Plants' (1858), he abandoned his former conclusion; for he there classes *Bursinopetalum* among the *Olacaceæ*, meaning, I presume, in Mr. Bentham's tribe *Icacineæ*. Mr. Thwaites has thus ignored the unquestionable grounds upon which the *Icacineæ* must remain separated from *Olacaceæ*. The *Icacinaceæ*, I have shown, must be a distinct order, contiguous to the *Aquifoliaceæ*, the one only differing from the other in the æstivation of the corolla. This last arrangement of Mr. Thwaites brings *Bursinopetalum* close to the place I have assigned it; and if the æstivation of its corolla had been truly valvate, his determination would have been perfectly correct, according to the Candolleian arrangement; but as the case is otherwise, the genus falls into *Aquifoliaceæ*, under the condition above proposed.

Mr. Thwaites is perfectly correct in his statement that the raphe is on the face of the seed opposite to the projection in the cell round which the seed is folded, but is wrong in his inference that, because it is so, such a projection can have nothing to do with the placenta: the fact is that not only in this instance, but in others of this family, as also in different orders of the Celastral alliance, and particularly, as I have demonstrated, in the *Icacinaceæ*, the raphe is frequently dorsal; and I have ventured to explain the cause of this occurrence in my memoir on the development of the anatropal ovule*. Mr. Thwaites has been unable to discover any incomplete dissepiment in the fruit of this genus, but only an inflexion of the putamen: this is simply a difference in terms; for it is undeniable that such a thick semi-septum exists, and is well figured by Dr. Wight (Icon. 956. f. 8). In the ovary, the rudiment of this projection is seen in the parietal nervure which extends from the apex to the base, and from the summit of which the ovule is suspended, as in *Villaresia*; this nervure, in both instances, is the displaced axis of the abortive cells, and contains the nourishing-vessels of the placenta.

The incrassation of the summit of the ovary in this genus assuming the appearance of an epigynous disk is not an uncommon feature even in the superior ovary, as I have long ago indicated in *Hyoscyamus*, in most of the *Olacaceæ*†, *Santalaceæ*, *Icacinaceæ*, and *Styracæ*.

* Ann. Nat. Hist. 3 ser. iv. 24; Contributions to Botany, i. 209.

† Ann. Nat. Hist. 2 ser. viii. 177; Contributions to Botany, i. 37.

BURSINOPETALUM, Wight. — *Flores* polygami. *Calyx* semiadnatus, apice liber et in dentes 5 acutos divisus. *Petala* 5, dentibus calycinis alterna, oblonga, apicibus 2-3-dentatis introflexis, intus nervo carinæformi instructa, in æstivatione quincuncialiter imbricata, valde decidua. *Stamina* 5, petalis alterna; *filamenta* subulata, subcomplanata, imo dilatata; *antheræ* 2-lobæ, lobis segregatis, ad connectivum carnosum cordiformem filamento apicifixum dorso collateraliter adnatis, singulis 2-locellatis, et rima longitudinali introrsum dehiscentibus. *Ovarium* semisuperum, in ♂ depressum, et radiato-sulcatum, in ♀ conicum, glandula disciformi apiculatum, 1-loculare, 1-ovulatum: *ovulum* e summo placentæ longitudinalis parietalis carinæformis suspensum. *Stylus* brevis, crassus, apice truncatus et cavus. *Stigma* obsoletum, in cavitate styli sistens. *Drupa* sicca, ovalis, dentibus calycinis emarcidis coronata; *putamen* coriaceum, crassissimum, indehiscens, revere 1-loculare, sed ob incrementum placentæ, nunc in laminam crassam longitudinalem fere ad axin loculi prolata, semibiloculare, monospermum. *Semen* suspensum, loculum implens, et hinc circa semiseptum longitudinale plicatum; *testa* e laminis 2 farsura cellulosa repletis crassiuscula, laxa, ad endocarpium semiadhærens, *raphe* dorsali chordiformi ea immersa; *integumentum internum* tenuissimum, testa multo minus, albumen arcte vestiens; *albumen* parciusculum, scaphiforme, utrinque acutum, testa æquilongum; *embryo* (sec. cl. Wight) parvus, in apice albuminis sepultus, *cotyledonibus* parvis acutis *radicula* tereti imo spectante tertia parte brevioribus.

Arbores *Indiæ Orientalis et Zeylanicæ, frondosæ*; folia alterna, elliptica, integra, subcoriacea, petiolata; paniculæ corymbosæ, terminales; flores subparvi.

1. *Bursinopetalum arboreum*, Wight, Spicil. Nielg. i. 22, tab. 24; Icon. iii. tab. 956; Walp. Ann. i. 124; Thw. Enum. Pl. Zeyl. 42; — ramulis rugosis, subflexuosis; foliis ellipticis, imo acutis et in petiolum subdecurrentibus, apice reflexis et repente angustato-attenuatis, acumine obtusiusculo, margine subrevoluto, superne paulo infuscatis, in nervis immersis sulcatis, subtus pallidis, nervis utrinque 3 venisque transversim reticulatis prominulis; petiolo longiusculo, angusto, canaliculato; panicula terminali, corymbosa, trichotome divisa, brachiis ultimis 3-floris, bracteolatis; floribus breviter pedicellatis. — *India Orientalis, v. s. (in flore) in herb. Hook.; in fructu in herb. meo*; Nielgherry (Wight et Gardner).

In my authenticated specimen, the leaves are $2\frac{1}{2}$ – $2\frac{3}{4}$ inches long, $1\frac{1}{4}$ – $1\frac{5}{8}$ inch broad, on a petiole 9 lines in length; the corymb is 2 inches broad and long, its primary branchlets are

alternate, the secondary are trichotomous, each forklet bearing three pedicellated flowers at its apex; the pedicles are 1 line long, and the flower expanded 3–4 lines diameter. The drupe is $1\frac{1}{4}$ inch long, 9 lines diameter; the putamen is ligneous, its sides being 2 lines thick, its cell 5 lines in diameter, with the false septum, 1 line in thickness, reaching to the axis of the cell; the testa measures 5 lines across, and the tegmen 3 lines, both plicated in a horse-shoe form round the false septum. In the fruit I examined, the embryo was not perfected*.

2. *Bursinopetalum macrophyllum*, Thw. in Hook. Kew Journ. Bot. vii. 242; Enum. Pl. Zeyl. 43;—ramulis strictis, subangulatis, opacis, fuscis; foliis ovato-oblongis, imo subacutis, et in petiolum subdecurrentibus, apice rotundato-obtusis, marginibus valde revolutis, subcoriaceis, supra fuscis, convexis, nervis invicem 7–8 venisque reticulatis utrinque prominulis, subtus subpallidis; petiolo costaque latiusculis, superne planis; corymbo terminali.—Ceylon, v. s. in *herb. meo*; Ramboddi, 5000 ped. altit. (Gardner, 100).

This† appears, by comparison with the foregoing, to be a very distinct species, as their characters respectively show. The leaves are $3\frac{1}{2}$ –4 inches long, 2 – $2\frac{1}{4}$ inches broad, on a petiole of 9 lines long and 2 lines broad. The fruit is of the same form, size, and structure as in the preceding species.

3. *Bursinopetalum tetrandrum*, Thwaites, Enum. Pl. Zeyl. i. 42.—Ceylon.

I saw long since, in Sir Wm. Hooker's herbarium, a plant collected in Malacca by Griffith, which in its habit and floral structure agrees with *Bursinopetalum*. Although its flowers are tetrandrous, I hardly think it will be found identical with the Ceylon plant.

XXVI.—On some new *Species of Acephalous Mollusca from the Sea of Japan.* By ARTHUR ADAMS, F.L.S. &c.

Genus CORBULA, Bruguière.

Corbula amplexa, A. Adams.

- C. testa transversim ovata, subtrigonalis, valde inæquivalvi, sæpe epidermide tenui fusca induta; valva dextra valvam sinistram amplectente, tenui, alba, concentrice striata, ad marginem ventralem

* Structural details of this species will be shown in the 'Contributions, vol. ii. pl. 73.

† A figure of this plant and section of its fruit will be given in the same work, pl. 73.

radiatim sulcata, postice producta acuminata et utrinque angulata, latere antico rotundato; margine ventrali postice sinuoso.

Hab. Mud-banks, estuary of the Peh-tang-ho (Lieut. Bullock).

Genus *VERTICORDIA*, Searles Wood.

1. *Verticordia japonica*, A. Adams.

V. testa suborbiculari, cordiformi, convexa, inæquilaterali, sub lente granulosa, radiatim valde costata, costis multis subdistantibus; incurvatis compressis; marginibus acutis denticulatis; margine ventrali valde dentato.

Hab. Gotto Islands (71 fathoms), where it lives in clean fine sand, particles of which usually adhere to the shell.

The labial palps are small. The mantle is closed, with the exception of a moderate elliptic aperture in front for the passage of the foot; the edges are thickened and furbelowed, wide apart on each side in front, approximate in the middle, where the mantle is closed and extended, and continued posteriorly, forming a common circular fringed opening, within which are the sessile siphonal orifices close together, the branchial larger than the anal. The foot is small, triangular, and compressed.

It has no relation, therefore, with *Trigonia*, the mantle of which is entirely open, and the foot large, long, and geniculate; on the contrary, its position, judging both from the nature of the animal and the form of the shell, would seem to be in the family Bucardiidæ, the animal differing from *Bucardia* (*Isocardia*) *cor* in the posterior opening being fringed.

The shell is very similar in form to the fossil *V. granulata* of M. Seguenza, from Sicily. It is quite different from *V. novemcostata*, Adams and Reeve, from the China Sea, and is the largest of the recent species.

2. *Verticordia multicostata*, A. Adams.

V. testa suborbiculari, inæquilaterali, cordiformi, subcompressa, sub lente granulosa, pallide fusca aut sordide alba, radiatim costata, costis numerosis confertis; marginibus subrotundatis, simplicibus; margine ventrali obsolete dentato.

Hab. Gotto Islands; 71 fathoms.

This species, single valves of which only were obtained, is distinguished from *V. japonica* by its compressed form and numerous close-set ribs.

Genus *ERVILIA*, Turton.

Ervilia japonica, A. Adams.

E. testa æquivalvi, transversim oblonga, inæquilaterali, clausa, latere

antico brevior rotundato, postico longiore producto subattenuato; alba, macula rufa elongata ad umbones ornata; superficie valvarum concentricè sulcata, sulcis regularibus confertis, area laterali postica lineis vix elevatis radiantibus instructa.

Hab. Tsu-Sima; 17 fathoms.

The conspicuous red elongate mark extending from the beaks on the anterior side of the valves will always serve to distinguish this species.

Genus *TELLIMYA*, Brown.

Tellimya japonica, A. Adams.

T. testa transversim oblonga, inæquilaterali, umbonibus acutis prominulis, latere antico brevior subtruncato, postico longiore rotundato, superficie valvarum tenuissime concentricè striata, striis confertis; alba, tenui, vix opaca.

Hab. Mino-Sima; 63 fathoms.

This species is more transversely oblong than *T. bidentata* from the seas of Europe, and the anterior side is much shorter.

Genus *MYRTEA*, Turton.

1. *Myrtea gibba*, A. Adams.

M. testa suborbiculari, solida, opaca, sordide alba, tumida, radiatim costata, costis subgranulosis distantibus, interstitiis valde punctatis; area laterali antica costis validioribus; margine ventrali sinuoso.

Hab. Tsu-Sima; 25 fathoms.

Very gibbose, with the interstices between the ribs coarsely punctate.

2. *Myrtea reticulata*, A. Adams.

M. testa orbiculari, gibbosa, solida, alba, opaca, costellis radiantibus subgranulosis et liris elevatis concentricis valde reticulata, costellis ad latera validioribus, in medio interdum subobsoletis.

Hab. Port Hamilton; 7 fathoms: Mino-Sima; 63 fathoms.

Gibbose and strongly reticulate, with granular radiating riblets and concentric ridges.

3. *Myrtea fimbriatula*, A. Adams.

M. testa suborbiculari, gibbosula, tenui, albida, antice valde sinuata, postice flexuosa, radiatim plicata, concentricè lamellata, lamellis tenuibus subdistantibus fimbriatulis, plicis ad latera validioribus.

Hab. Tabu-Sima; 25 fathoms.

The chief character consists in the thin, wide-apart, fimbriate lamellæ.

4. *Myrtea lamellata*, A. Adams.

M. testa transversim oblonga, subcompressa, tenui, sordide alba, latere postico declinato, antico sinuoso, concentrice lamellata, lamellis tenuibus regularibus confertis crenellatis.

Hab. Tsu-Sima; 26 fathoms.

5. *Myrtea plicatula*, A. Adams.

M. testa transversim oblonga, compressiuscula, tenui, semipellucida, alba, radiatim plicata, plicis regularibus et lineolis lamellosis tenuibus concentricis subdistantibus decussata, latere antico superne elevato et dilatato.

Hab. Tsu-Sima; 26 fathoms: Mino-Sima; 63 fathoms.

Thin, plicate, with distant elevated lines, and the front upper margin dilated.

6. *Myrtea obesula*, A. Adams.

M. testa transversim oblonga, alba, gibbosa, solida, lunula rufo tincta, radiatim costata, costis validis granulosis divergentibus, in medio subobsoletis, concentrice lirata, liris validis confertis regularibus.

Hab. Tabu-Sima; 25 fathoms.

Very gibbose, transversely oblong, strongly ribbed and granular.

7. *Myrtea decussata*, A. Adams.

M. testa suborbiculari, subcompressa, sordide alba, opaca, tota radiatim costellata, costellis confertis lævibus, concentrice lirata, liris undulatis lævibus elevatis.

Hab. Tabu-Sima; 25 fathoms.

Entirely finely decussated by radiating riblets and concentric elevated lines.

8. *Myrtea circinata*, A. Adams.

M. testa orbiculari, alba, tenui, compressa, latere antico valde sinuato, latere postico flexuoso, concentrice lamellata, lamellis crassis regularibus confertis utrinque validioribus.

Hab. Mino-Sima; 63 fathoms.

A *Dosinia*-like species, with regular concentric lamellæ.

9. *Myrtea delicatula*, A. Adams.

M. testa transversim oblonga, obliqua, subcompressa, tenui, semi-opaca, alba, utrinque rotundata, radiatim plicata, plicis rugulosis, in medio evanidis.

Hab. Korea Strait; 46 fathoms.

A thin, white, obscurely plicate species.

Genus *CRYPTODON*, Turton.

1. *Cryptodon japonicus*, A. Adams.

C. testa oblonga, longiore quam latiore, alba, tenui, semiopaca, latere antico excavato, lunula impressa distincta, latere postico longitudinaliter plicato, margine valde sinuato; concentrice creberrime striata.

Hab. Okosiri; 35 fathoms.

2. *Cryptodon Manchuricus*, A. Adams.

C. testa quadrato-orbiculari, pallide fusca, ferrugineo tincta, semipellucida, concentrice striata, latere antico subdilatato, postico flexuoso.

Hab. Coast of Manchuria; 20 fathoms.

3. *Cryptodon oblongus*, A. Adams.

C. testa oblonga, longiore quam latiore, alba, tenui, subpellucida, latere antico declinato rotundato, lunula inconspicua, latere postico plicato; margine sinuoso.

Hab. Mino-Sima; 63 fathoms.

4. *Cryptodon plicatus*, A. Adams.

C. testa quadrato-orbiculari, alba, tenui, semipellucida, latere antico rotundato excavato lunula inconspicua obsoleta, latere postico valde plicato; margine sinuoso; superficie valvarum concentrice striata.

Hab. Mino-Sima; 63 fathoms.

5. *Cryptodon sulcatus*, A. Adams.

C. testa trigonali-orbiculari, sordide alba, subcompressa, ferrugineo tincta, solidiuscula, concentrice sulcata, sulcis antice incrassatis productis, latere antico rotundato, postico flexuoso.

Hab. Coast of Manchuria; 35 fathoms.

6. *Cryptodon (Clausina) subquadratus*, A. Adams.

C. testa quadrato-orbiculari, tumidula, pallide cornea, concentrice sulcata, latere antico subtruncato, postico rotundato; margine ventrali rectiusculo.

Hab. Coast of Manchuria; 20 fathoms.

Wants the posterior plicature of *Cryptodon*; subquadrate, concentrically grooved.

7. *Cryptodon (Clausina) suborbicularis*, A. Adams.

C. testa suborbiculari, ventricosa, tenui, albida, cornea, concentrice striata, latere antico producto rotundato, postico rotundato; margine ventrali arcuato.

Hab. Amiva Bay; 17 fathoms.

Has the posterior fold of *Cryptodon* proper; is small, suborbicular, concentrically striate.

Genus LEPTON, Turton.

Lepton japonicum, A. Adams.

L. testa orbiculari subæquilaterali, compressa, tenui, sordide alba, superficie concentrice striata, area antica obtusim subangulata, utrinque rotundata; margine ventrali regulariter arcuato.

Hab. Tabu-Sima; 25 fathoms.

The surface of the valves is concentrically striated, and not shagreened as in some species.

Genus GALEOMNIA, Turton.

Galeomnia japonica, A. Adams.

G. testa tenui, transversim ovata, subæquilaterali, alba, radiatim tota striata striis elevatis confertis, concentrice substriata striis concentricis irregularibus, umbonibus medianis acutis; margine ventrali arcuato.

Hab. Mino-Sima; 63 fathoms.

The ventral margin is but very slightly gaping, and the surface of the valves is radiately striated.

Genus CRENELLA, Brown.

1. *Crenella spectabilis*, A. Adams.

C. testa oblongo-orbiculari, tumida, alba, tenui, striis elevatis confertis radiantibus tota striata; margine cardinali antice crenulato, postice lamella infra-marginali instructo; latere antico rotundato, postico subangulato; superficie lineis incrementi concentrice impressa.

Hab. Mino-Sima; 63 fathoms.

This, I suspect, is the largest species hitherto described. It is a delicate, thin, white shell, entirely striated from the beak in a radiating manner, with fine elevated lines; its greatest diameter is from the beak to the ventral margin.

2. *Crenella decorata*, A. Adams.

C. testa transversim oblonga, tumida, obliqua, latere antico brevior, postico longiore rotundato, striis radiantibus et concentricis decussata, lutescente, fasciis rufo-fuscis radiatim picta; margine ventrali crenulato.

Hab. Port Hamilton; 7 fathoms.

This is a prettily marked, transversely oblong, tumid species, considerably larger than *C. decussata*, Ment.; the radiating red-brown bands are narrow at the beak, and gradually widen as they approach the ventral margin.

3. *Crenella cornea*, A. Adams.

C. testa oblonga, obliqua, tumida, subpellucida, cornea, tota radiatim striata, striis elevatis confertis, lineis incrementi concentricis instructa; latere antico brevior rotundato, postico longiore subangulato; margine ventrali crenulato.

Hab. Korea Strait; 46 fathoms.

A thin, horn-coloured, semipellucid species, entirely radiately striated, and of an oblong form, with the greatest diameter from the beak to the ventral margin.

4. *Crenella sculptilis*, A. Adams.

C. testa oblonga, crassiuscula, albida, lineis concentricis validis instructa, radiatim costellata, costellis planis lævibus, interstitiis granulis moniliformibus concinne sculptis; marginibus ventrali et cardinali crenulatis.

Hab. Chosan Harbour; 6 fathoms.

The beak in this prettily sculptured species is nearly terminal, and the shell is ovate-oblong, the greatest diameter being from the umbo to the ventral margin.

5. *Crenella crocea*, A. Adams.

C. testa transversim oblonga, obliqua, subrhomboidea, nitida, cornea, sulculis radiantibus confertis lineisque elevatis concentricis tota decussata; latere antico brevior, postico longiore rotundato; marginibus cardinali et ventrali regulariter crenulatis.

Hab. Tsu-Sima; 30 fathoms.

A radiately sulcate and decussate, shining, saffron-coloured species, with the entire margin, cardinal and ventral, conspicuously crenate.

6. *Crenella casta*, A. Adams.

C. testa oblonga, obliqua, tumida, lactea, nitida, radiatim striata, lineis incrementi concentricis impressa, fasciis duabus pallide carneolis ornata; margine valvarum crenulato; intus vivide margaritacea.

Hab. Mino-Sima; 63 fathoms.

A very beautiful, shining, milk-white species, finely radiated throughout, and adorned with two crescentic pinkish bands.

GENUS MODIOLARIA, Beck.

Modiolaria pusio, A. Adams.

M. testa transversim oblonga, obliqua, parva, tenui, fusca, latere antico brevior, postico rotundato, costellis radiantibus utrinque

ornata, costellis in medio nullis, lineolis concentricis incrementi striolata; margine ventrali crenulato.

Hab. Mino-Sima; 63 fathoms.

A small species, very nearly similar in form to *Crenella*, but with the middle of the valves plain.

Nagasaki, July 10, 1861.

XXVII.—On Vision in the Arthropoda. By Dr. H. Dor*.

COMPOUND eyes occur in nearly all Crustacea, in all winged and some apterous insects, and even in the aquatic larvæ of the Neuroptera, and in the larvæ of the Hemiptera. They are two in number, and form a segment of a sphere; and each is composed of an agglomeration of more simple organs, of which the number varies almost infinitely (from 50 to 25,000 in a single eye). The facets formed by the single eyes resemble the cells of a honeycomb: they are usually hexagonal, but sometimes pentagonal, rectangular, or irregular; and these various forms may be met with in the same eye.

On making an antero-posterior section of the eye, each facet is found to correspond with a more or less lenticular organ, exactly resembling in some species the crystalline lens of the Vertebrata. This has been called the *cornea*. Behind it is the *crystalline body*, a transparent and strongly refractive cone, enclosed in a cupuliform envelope, which is also transparent and is perfectly continuous with the nervous fibre. The union of all the nervous fibres, which in their course almost constantly present a dilatation and afterwards traverse several masses of ganglionic cells, forms the optic ganglion. The spaces between the different nervous fibres are filled up with a dark pigment.

The author gives a summary of the different views put forward by writers on the mechanism of vision in the Arthropoda. Cuvier supposed that the nervous filaments, although each corresponding to a facet, lost themselves in the layer of pigment; and he found it difficult to understand how impressions could be produced upon them through this opaque matter. Marcel de Serres did not recognize the conical crystalline bodies, the discovery of which is due to Treviranus (Verm. Schriften, iii. p. 152), who, however, did not perceive their importance. According to him, the compound eyes act like a convex mirror, upon which objects are reproduced enlarged, the entire cornea reflecting images of distant objects, and each facet those of neighbouring objects.

* Abstract from the 'Bibliothèque Universelle,' 1861, "Archives des Sciences Physiques et Naturelles," p. 328.

J. Müller considered that each facet, with its conical body and the nervous filament attached to it, forms an apparatus which transmits to the optic ganglion only the impression of that luminous ray emanating from an external body which penetrates it in the direction of its axis, the oblique rays being absorbed by the pigment. The impressions transmitted to the optical centre by all the filaments will form a common and continuous image. The extent of the field of vision will depend on the more or less hemispherical form of the eye; and the distinctness of the image produced, upon the length of the cones, the nearness of the object, and the number of the facets. The curvature of the surface of the cornea, which enabled Leuwenhoeck to obtain reversed images with the eyes of insects, is only sufficient, according to Müller, to concentrate the rays in each cone towards the point of insertion of the nervous fibre.

As early as 1759, Porterfield had stated that the compound eyes of insects consist of as many simple eyes as they present facets; that these animals see with their innumerable eyes in the same way as Man with two and Spiders with eight, and that the number of these organs was destined to replace the movements of the eye in Vertebrata. In 1843, Brants adduced the fact, already demonstrated by Leuwenhoeck, of the presence of a reversed image corresponding to each facet, but invented a theory of interlacement of the nervous fibres in order to bring this fact into accordance with the general theory of Müller.

Of the authors who endeavoured to combat this theory, one of the first was Gottsche, who, in 1852, proved that when the crystalline body and the cornea are placed together in the microscope, an image is obtained at the conical extremity of this body. His conclusion is that the compound eyes are organs of a nature *sui generis*, and not to be compared with the visual organs of the members of other classes of animals.

In 1855, Leydig put forward a theory which has taken the place of that of Müller. He assumes, with Gottsche, that the crystalline body, its envelope, and the soft layer described by Will between the crystalline and the cornea, are not organs corresponding with and attached to the nervous fibres, but *that they are the anterior extremities of these fibres themselves, of which the form alone is altered, there being no difference between them and other parts of the nervous system, either chemically or optically*. In this view the optic ganglion becomes the analogue of the retina in the higher animals, the crystalline bodies being analogous to the bacillar coat. Leydig compares the faceted eye of an Arthropod to the eye of a vertebrate animal, as follows:—“The *cornea with its posterior convexity* corresponds to the cornea and crystalline of the Vertebrata; the *crystalline body* (with the so-called vitreous body) and the nervous fibre which is attached

to it, to the *bacillar coat*; and lastly, the optic ganglion to those *layers of the retina* which are composed of granulations, cells, and nerve-fibres. The *pigments* are the analogue of the *choroid* and the *iris*; and the transversely striated muscular fibres have their equivalents in the muscular elements of the choroid and iris."

The researches of Leydig were followed by investigations of the anatomy of the compound eye by Zenker, Gegenbaur, and Leuckart, and on its embryology by Claparède. Zenker found the curvature of each facet of the eye in *Dytiscus* to equal 160° . The index of refraction of the cornea = 1.50, and that of the crystalline body = 1.40. He concludes that the vitreous body is placed behind the cornea only to prevent the convergence of the rays behind the cornea, so as to form an image before reaching the summit of the crystalline body. In this view, opposed to Leydig, the compound eye is an aggregation of simple eyes. Gegenbaur, on the contrary, adopts Leydig's view, and thinks he has demonstrated an uninterrupted communication of the crystalline body and nervous fibre with the optic ganglion in a Hyperid Crustacean.

Leuckart, on the other hand, not content with the various hypotheses amongst which he had to choose, adopts another, still more difficult to understand. He states that between the cornea and the crystalline body there is a space containing a vitreous gelatinous body enclosed in a proper envelope. Some muscular fibres found in this envelope may, by their contraction, approximate the crystalline body to the cornea; in other words, there exists a special organ of accommodation. Besides all this, in the genera *Sapphirina*, *Corycaeus*, &c., the crystalline is said to be composed of two distinct parts, exactly like the crown and flint glass in achromatic lenses. These observations the author has been unable to verify. Leuckart compares each facet of such eyes, not to a camera obscura, but to a telescope with a simple object-glass (cornea) and eye-piece (posterior lens); and he considers this view to be the more probable as movements of the posterior lens may be observed which can have no other object than to adapt the apparatus to different distances.

Claparède thinks Müller's theory untenable, and also cites some facts which speak against Leydig's views; but he avoids giving his own.

This being the state of the question, the author endeavoured, by fresh researches, to solve the problem, How is vision effected in the Arthropoda? For this purpose it was necessary to confirm or refute Leydig's theory, Müller's being already upset by the observations of Leuwenhoeck; whilst Leuckart's seemed untenable to him, because, if insects really possess a telescope, they would require an eye behind it to enable them to see. It is by optical processes that he attempts the solution of his problem.

It is easy to calculate the focal distance, $a b$, of a lens, when we know the size of the object $c d$, its distance from the lens, $a f$, and the size of the image, $g h$. We get two triangles, $c a d$ and $h a g$, of which the sides and perpendiculars are proportional. Thus we get $x : f a = h g : c d$. As these three quantities are known, it is perfectly easy to find the focal distance $a b$.



The author commenced by making numerous preparations, until he had the corneæ of many insects in a sufficiently clean state to show the images very distinctly. He then pasted upon a window a rectangle of black paper of known dimensions, and measured accurately the distance from the stage of the microscope to the window. When the facets were in focus, they were seen very distinctly, but without images of the black paper; on their removal from the focus, their outlines became less clear; but gradually small images of the black rectangle made their appearance, and grew more and more distinct, until by one or two turns of the screw they again disappeared. It was therefore evident that each facet formed an image, and that this was at a sensible distance behind its posterior surface. It was therefore a true lens, and the image must be reversed, which proved to be the case on examining another object.

This observation proves that the image is not produced, as stated by Leydig, on the anterior surface of the crystalline body, acting as a bacillus, for the latter is often in immediate contact with the surface of the lens. Nevertheless, it might be urged that although the image is no doubt formed behind the optical centre of the lens, by the admission of even a thin layer of the so-called vitreous body the image might really be formed very close to the anterior surface of the crystalline body; or the crystalline body itself might be at once refractive and nervous, and the image might be formed at different depths in it according to the distance of the objects observed. To determine these points, the author entered upon a series of accurate measurements, of which the results are given in his paper. The following are those which bear most directly upon the subject:—

Cornea of *Musca vomitoria*.

Magnifying power 560 diameters.

Size of the image seen under microscope = 0.458.

Real size of image = 0.0082 = $\frac{1}{122}$ mill.

Distance of object = 68.8 centim.

Size of the object = 120 mill.

Whence $x : \frac{1}{122} = 688 : 120$, from which $x = \frac{1}{21}$ mill.

This calculation leads to a very conclusive positive result. Leaving out the determination of the optical centre, the image was formed far behind the posterior face of the lens, the focal distance $\frac{1}{21}$ being exactly twice the thickness of the lens, which was $\frac{1}{42}$ mill.

The next point was to determine the length of the crystalline body, and to calculate at what part of it the image might be formed. The most favourable species for this purpose appeared to him to be the *Macroglossus stellatarum*, as its eyes are hard and prominent. The results are given from the mean of three measurements.

Macroglossus stellatarum.

First measurement.—Magnifying power 838 diam.

Apparent size of the image 3.48, real size $0.0089 = \frac{1}{112}$ mill., from which x (focal distance) $= \frac{1}{16}$ mill.

Second measurement, the same eye, magn. 255 diam.

Apparent size of the image 2.44, real size $0.0091 = \frac{1}{110}$ mill., from which $x = \frac{1}{15} \cdot \frac{9}{10} = \frac{1}{16}$ mill.

Thickness of lens $= \frac{1}{25}$ mill.

Measurement of crystalline bodies (mean of five measurements of different crystalline bodies).—Apparent size $= 15.59$, real size $0.061 = \frac{1}{16}$ mill.

The author was the more struck with this coincidence of the focal length of the lens and the length of the crystalline cone, as his only endeavour had been to prove whether the image was formed immediately behind the cornea, as was necessarily assumed in Leydig's theory. The focal distance of the cornea measured in the air being $= \frac{1}{16}$ mill., and the summit of the cone being at the same distance from the posterior surface of the lens, the difference between the refraction of the air and that of the crystalline body is sufficient to shift the position of the image for a distance equal to that between the posterior surface of the lens and its optical centre. Thus, if, as stated by Zenker, the index of refraction of the crystalline body be 1.40, we should have, in the preceding case,

$$1.00 : 0.0625 = 1.40 : x;$$

$$\text{from which } x = 0.0875 = \text{circa } \frac{1}{11}.$$

Hence the optical centre would be placed forward in the cornea by the whole difference between $\frac{1}{11}$ and $\frac{1}{16}$, or about $\frac{1}{40}$ mill. Now, as the antero-posterior diameter of the cornea in the *Macroglossus* is $\frac{1}{25}$, the optical centre would be about $\frac{1}{60}$ mill. behind the anterior surface of the cornea.

The author concludes his paper with the following remarks:—"We assume without hesitation that each facet is a complete

eye, perfectly analogous to the simple eye of the Vertebrata. The *lenticular cornea* corresponds with the *cornea* and the *crystalline apparatus*; the *cone* with the *vitreous body*; and the *cupuliform envelope*—which up to the time of Leydig was considered as conjunctive tissue, as neurilemma (J. Müller), and which Leydig regards as an integral part of the bacillus—is for us a true *retina*, a dilatation of the optic nerve. We have not ascertained the presence of muscular fibres. The pigments replace the choroid, and the multiplicity of eyes the small muscles destined to move the eyes of the superior animals in various directions. If, as M. Claparède points out with reason, there be some species in which Leuwenhoek's images are not observed under the microscope, it must be owing to the convexity of their facets being very slight. The image is formed nevertheless, but much further backwards than it is usually looked for. We find such eyes in the *Tabani*; and in these the length of the crystalline bodies corresponds with the slight curvature of the cornea, for they are about seven times as long as the thickness of the cornea. The mechanism of vision is therefore the same as in Man. One fact alone is not yet clear—namely, how distinct images can be formed upon a conical retina. But is the retina of Man always perfectly spherical? In any case, we no longer admit, with J. Müller, that the only point sensible to light is the entrance of the optic nerve; for, to judge at least by analogy with the Vertebrata, this may very probably be the only blind point; and we cannot understand how this distinguished physiologist could assume that, the pigment absorbing all the luminous rays which fall upon the sides of the cones, there could be no perception of light upon these points, as if the choroid in Man prevented the functions of the retina.

“Lastly, it is not more difficult to explain simple vision with 12,000 eyes, as in the *Libellula*, than with the two eyes of Man. Each eye in insects gives an image slightly different from that of the eye which is immediately in contact with it. But does not Wheatstone's admirable discovery, by throwing down the old doctrine of identical points, prove that the same thing takes place in our two eyes? It is owing to the presence of two different images for the two eyes that we possess stereoscopic vision, that we appreciate distances, perspective, &c. This is the case also in insects, which will see the more exactly in proportion as they have more facets. Thus the Ant, which moves slowly, does not require so exact an appreciation of distances as Butterflies, Dragon-flies, and other winged insects. For this reason probably we only find in the former 50 facets, whilst the Dragon-fly has 12,000, and the Butterfly 17,000.”

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

January 16, 1862.—Dr. William Allen Miller, Treasurer and Vice-President, in the Chair.

“On the Development of Striped Muscular Fibre in Man, Mammalia, and Birds.” By J. Lockhart Clarke, F.R.S.

In the domestic fowl, until the beginning of the fifth day of incubation, the so-called voluntary muscular tissue consists only of a crowded multitude of free nuclei imbedded in a finely granular blastema; the nuclei are round, oval, pyriform, and somewhat angular, with granular contents. On the fifth and sixth days of incubation, fibres become superadded under two forms,—1st, as processes extending from the ends, or from the sides of nuclei; 2nd, as narrow bands, either uniformly delicate and pale, or bordered by darker outlines, and containing nuclei at variable intervals. They are most numerous near the surface of the layer, and probably belong, at least partly, to the muscular layer of the skin. In every case their first stage of development is conducted on one general plan, which consists in the fibrillation of the blastema along the sides of nuclei, to which the fibrillæ so formed become adherent. Sometimes these fibrillæ or lateral fibres enclose a single nucleus with conical processes of blastema, so that the object occasionally presents some resemblance to a fusiform nucleated cell. More frequently, however, they enclose a linear series of nuclei at variable distances from each other, but cemented together by blastema, which sometimes assumes around each a more or less definite shape. In the formation of the paler fibres, however, a series of neighbouring nuclei may sometimes be seen first to collect round themselves granular masses of a more or less fusiform appearance, and then to coalesce with each other, in an oblique or alternately imbricate way. Sometimes a series of the nuclei themselves overlies each other in an imbricate form like a number of coins, and are cemented together by a common layer of blastema.

In the early part of the seventh day of incubation, numerous fibres of a much larger and more striking description suddenly make their appearance in the nucleated blastema. They originate, however, on the same general plan as the others, in a fibrillation of the blastema between, or along the sides of, a variable number of nuclei; but the process goes on to form aggregate masses of a much larger kind, and of a more or less oval, fusiform, or cylindrical shape, in which the nuclei are ultimately enclosed. Some of these bodies have a very striking resemblance to organic muscular-fibre-cells, which, according to my own opportunities of observation, are developed on the same general plan, that is, by the formation of sarcous substance, first, in the shape of fibres or lateral bands along the sides of a nucleus more or less encrusted with blastema, so that the *organic* muscular-fibre-cell would appear to represent an early stage in the development of the *striped* muscular fibre.

As incubation advances, the fibres acquire a tubular investment of the contractile or sarcous substance, which gradually increases in thickness or depth, and appears on each side as a band of corresponding breadth. As they grow in length, they also contract in diameter, and become of uniform structure throughout; while their nuclei rise nearer to the surface, and assume a more oval form. At this period the marks of striation, either longitudinal or transverse, are only faint and occasional.

By the fourteenth day of incubation, the entire substance of the fibres separates into longitudinal fibrillæ, which in turn become shortly resolved into particles or sarcous elements. After this the fibres continue to grow in thickness by the addition, to their surfaces, of new fibrillæ, which, as usual, are formed around nuclei encrusted with blastema cementing them, in such cases, to the original fibre.

In mammalia, although there are some particular but unimportant differences in the development of muscular fibre, the general plan is the same as in birds. The nuclei—at least in the ox, sheep, and pig—are larger, and have more distinct cell-walls or enveloping membranes. The fibres of the sheep or pig first make their appearance, in the fœtus of from half to three-quarters of an inch in length, as thick and nearly parallel threads lying amongst a densely crowded mass of free nuclei. When isolated, these fibres are seen to be attached to one or more of the nuclei by a variable quantity of blastema. Sometimes a single nucleus with conical processes of delicate granular substance is first enclosed by fine fibrillæ or lateral bands, which present somewhat the appearance of a *cell-wall*, so that the object has a certain resemblance to a nucleated fusiform cell with a fibre originating from one of its extremities. Sometimes several nuclei are cemented in a group around a fibre, and become subsequently covered by other fibres of the same kind; and sometimes they lie in linear series, either at some distance apart, or overlying each other to a certain extent like a series of coins. The lateral bands or fibres enclosing the nuclei extend around them as a tubular investment, which grows in thickness from without, but not always uniformly on all sides. In the process of longitudinal growth, the nuclei multiply by subdivision, become generally more oval, and approach nearer to the surface of the fibre, which at the same time contracts in diameter. The subsequent changes they pass through are nearly similar to those which occur in the chick.

In man the development of muscular fibre proceeds on the same general plan as in birds and mammalia, but differs from that of both in certain unimportant particulars. In the early stages there is no distinct appearance of those oval, cylindrical, and irregular masses observable in the chick on the seventh day of incubation and in the mammal at a corresponding period. In this respect there is a greater resemblance between the two latter classes than between man and either. In the human fœtus, from about half to three-quarters of an inch in length, the first stage of development may be seen to commence by the formation of fine lateral bands or fibrillæ along one or both sides of one nucleus or more. When, however, there are more nuclei than one enclosed by the same lateral bands, they are always

disposed in linear succession, with their longer axes in the direction of the fibre, and never occur in irregular groups, as is sometimes the case both in birds and mammals, in which, consequently, the same kind of fibres are often broader at first. Thus formed, they lie side by side in bundles of different sizes, to which new fibres or new fibrillæ are being continually added by a renewed process of development. Every fibre is the rudiment of several fibrillæ. At this period each lateral band constitutes a single fibrilla, which is often resolved into sarcous elements of great distinctness and beauty, while new and similar fibrillæ are developed along its sides in the way already explained. The subsequent series of changes do not differ materially from those that occur in the inferior classes.

It is evident that this description of the development of muscular fibre is entirely opposed to the cellular theory of Schwann; while it agrees in some points with that of Lebert (*Annales des Scien. Nat.* 1849-50), but more with that of Savory (*Phil. Trans.* 1855). In no instance have I found that nucleated *cells*, properly so called, are concerned in the office of development; for the finely granular blastema attached to the nuclei, although it frequently assumes the shape of a fusiform *cell*, is not invested with a *cell-wall*, in the proper sense of the word. Such an envelope, however, is sometimes simulated by the investing sarcous substance or fine lateral fibrillæ when they are first laid down on the sides of the fusiform mass and meet each other at each extremity to form a single fibre or process. Indeed, according to my own observations, as already remarked, this is precisely the mode in which the *organic* muscular-fibre-cell is developed; so that the *striped* muscular fibre, instead of being the *product* of nucleated *cells*, would appear to be itself, at first, an instance or mode of cell-formation, which finds its prototype in the *organic* muscular fibre-cell, and in which the *cell-wall* is substituted and represented by the investing sarcous substance.

January 23, 1862.—Major-General Sabine, R.A., President,
in the Chair.

“Additional Observations and Experiments on the Influence of Physical Agents in the Development of the Tadpole and the Frog.”
By John Higginbottom, Esq., F.R.S.

In a former paper “On the Influence of Physical Agents on the development of the Tadpole of the Triton and the Frog,” which the Royal Society honoured with a place in the *Philosophical Transactions* for 1850, experiments were detailed to prove that the ovum of the frog (the *Rana temporaria*) underwent its metamorphosis in the absence of light, contrary to the experiments of Dr. W. F. Edwards of Paris, related in his work ‘On the Influence of Physical Agents on Life.’

My most satisfactory experiment was made in a rock cellar 30 feet deep, where no solar light ever entered; the mean temperature of the cellar was 51° Fahr.,—I believe, the lowest temperature at which the transformation could be effected.

The ova of the frog, just deposited, were placed in the cellar on

the 11th of March, and on the 31st of October the first was fully developed in the form of a frog; while other ova deposited on the same day, which were placed in a shady part of a room at 60° Fahr. and covered with several folds of black calico, were fully developed on May 22nd, twenty-three weeks earlier than those in the cellar.

The experiment proved that the development of the frog depended upon the temperature, and not upon the presence of light. I found by other experiments that those in the light, and those deprived of light, were equally developed if placed at the same temperature. I observed that an excess of light retarded the development.

1. *On the Influence of Light on the Ovum.*

My former experiments not being parallel with those of Dr. Edwards, I was desirous of following his steps. Dr. Edwards says, in his work above referred to, Part iv. chapter 15, 'On the Influence of Light upon the Development of the Body,' "This process, previous to birth, is generally carried on in the dark; there are, however, animals whose impregnated eggs are hatched, notwithstanding their exposure to the rays of the sun. Of this number are the Batrachians. I wished to determine what influence light independent of heat might exert upon this kind of development. With this view I placed some spawn of the frog in water in a vessel which was rendered impermeable to light by dark paper. The other vessel was transparent; they were exposed to the same degree of temperature, but the transparent vessel received the rays of the sun. The eggs exposed to the light were developed in succession; of those in the dark, none did well; in some, however, I remarked unequivocal indications of the transformation of the embryo."

Dr. Edwards does not mention the depth of water in the vessel in which he put the spawn of the frog, which he "rendered impermeable to light." If it were a few inches in depth, it would materially prevent the transformation of the embryo.

I commenced my experiment in a pool which had been the habitat of frogs (the *Rana temporaria*) for several years.

Experiment 1st.—I put a quantity of spawn, just deposited, into a box perforated with small holes, so as to admit a free current of water through it, and placed it about 3 feet below the surface of the water; all the ova perished.

The next experiments were made in an aquarium 20 inches deep, containing seventeen gallons of water at 60° Fahr.

Experiment 2nd.—A quantity of spawn was put into the water, which fell to the bottom of the aquarium; the spawn when first deposited by the frog, is specifically heavier than the water*. The

* It is found that the frog usually deposits her spawn in shallow water, often close to the edge of a pool favourable to its development; at first it is very adhesive, and adheres firmly to the ground or weeds where it is deposited. The same condition may be observed when the animal deposits her spawn in an earthenware vessel. In this neighbourhood the deposition begins about the end of February or the first days of March, and continues fourteen or sixteen days, when the frogs quit the water.

ova enlarged as usual, but did not arrive satisfactorily through the branchial state; most of the ova appeared to undergo no change whatever.

Experiment 3rd.—Some spawn was placed 8 inches below the surface of the water; but none of the ova passed through the branchial state.

Experiment 4th.—A quantity of spawn was placed on rock work near the surface of the water. Nearly all the ova passed satisfactorily through the branchial state to the formation of tadpoles; each of the experiments was made at the same time and at the same temperature.

Experiment 5th.—A quantity of spawn was put into two round shallow dishes, each containing two pints of water, which were placed on the stand of the aquarium at the same time as in the former experiments; nearly all did well; and during the full branchial or fish-like state, great numbers of the embryos had placed themselves close to the margin of the water, forming a dark circle, with their branchiæ nearly exposed to the atmospheric air. They do not appear to feed during this period on the jelly—their first food; atmospheric respiration seems more needful than food for their existence for several days during their full branchial state*.

There are two distinct metamorphoses from the ovum to the full development of the frog: the first from the branchial or fish-like state to that of the tadpole; the second from the tadpole to that of a frog,—the first requiring for its existence a close approximation to the atmospheric air, the second requiring full atmospheric respiration, to which I shall hereafter refer.

The branchial state continues about nine days, from the first bud-dings of the branchiæ to their absorption. About the seventh day the branchiæ are absorbed on the *right side*, indeed so quickly that I have observed that scores have lost them during one night, whilst the branchiæ on the left side have apparently been perfect; but these in their turn become absorbed during the next day; the respiration of this newly formed tadpole now depends on the internal gills and cutaneous surface. The gill-opening for the passage of water is very apparent on the left side, but there is none on the right.

2. *On the Influence of Light on the Tadpole.*

The experiments of Dr. Edwards indicate that a decided influence is exerted by light upon the metamorphosis of Batrachians, since, according to his statement, when tadpoles which had arrived at nearly their full growth were secluded from the influence of light,

* The ova of the toad appear to be less tenacious of life than those of the frog. I have observed, when they are placed 4 or 5 inches below the surface of the water, they all die; but they live when the long jelly lines in which the ova are enclosed are floated on weeds, or on a network of sticks on the surface of the water. In my note-book on the tadpole of the toad in 1849, I found that after the gelatinous lines began to break up on the surface of the water, and the ova to separate from them, a number of the eggs undergoing the metamorphosis adhered to the sticks and weed, but those falling to the bottom of the vessel perished.

but supported with aerated water and food, they attained an extraordinary size, without undergoing any metamorphosis. The following is Dr. Edwards's experiment:—"I procured a tin box, divided into twelve compartments, each of which was numbered and pierced with holes so that the water might readily pass through the box. A tadpole (which had been previously weighed) was put into each compartment, and the box was then placed in the River Seine, some feet below the surface. A large number were at the same time put into an earthen-ware vessel, containing about four gallons of Seine water, which was changed every day; these tadpoles were at liberty to rise to the surface and respire air, and they soon went through their metamorphosis. Of the twelve placed in the box under water, ten preserved their form without any progress in their transformation, although some had doubled or trebled their weight. It should be observed that at the time when the experiment was begun, the tadpoles had attained the size at which the change is about to take place. Two only were transformed, and these very much later than those which, in the earthen vessel, had the liberty of respiration in air." Dr. Edwards concludes that the presence of solar light favours the development of form.

The situation in which Dr. Edwards placed the tadpoles, "some feet below the surface of the river" in his experiment, would inevitably prove unsuccessful in the full development of the frog. I have always found the transformation, both of the triton and of the frog, equal in the same temperature, both in the light and in the absence of light, if placed in shallow water; but during their metamorphosis they must be allowed to rise to the surface of the water to obtain air, or they become asphyxiated. I therefore placed stones in the vessel, and allowed them to leave the water for the purpose of atmospheric respiration.

The metamorphosis of the tadpole, when at its *full* growth, requires about fourteen days to bring it to the condition of a frog. About the termination of that period, the diminution of the body is so great, and also the absorption of the expanded caudal extremity is such, as to diminish cutaneous respiration. Respiration by the lungs becomes absolutely necessary to prevent the animal from becoming asphyxiated, which would be the case if it remained in the water—requiring then not an aquatic, but an atmospheric medium of respiration. It may be observed that after the tail is partially absorbed, leaving only a portion of the solid part, the asphyxiated state has commenced; the little animal, with open mouth, gasps for breath: but if removed into atmospheric air, the mouth is directly closed, and respiration is effected through the nostrils with perfect freedom; the animal is restored directly, jumps about and is lively.

3. On the Influence of the absence of Light on the Tadpole and on the Frog.

This time I commenced my experiments in three rock cellars, formerly only in one.

The cellars in Nottingham, cut out of solid rock, are most favourable for experiment; no solar light ever enters, and they are not subject to any great change of temperature. The deepest cellar is 30 feet deep, the mean temperature 51° Fahr.; the middle cellar is 18 feet deep, its mean temperature 53° Fahr.; the uppermost cellar 9 feet deep, mean temperature 56° Fahr.

June 11th. In each cellar I placed a shallow glazed earthenware vessel, containing two pints of water, with grass for chlorophyll for food, changing the water every second day. In each vessel I put twenty tadpoles, approaching the period of their metamorphosis, following the example of Dr. Edwards,—a much easier method than commencing with the spawn.

In the uppermost cellar ten were fully developed in the form of a frog on the 8th of September, and were on the stones, having left the water.

In the middle cellar ten were fully developed on the 22nd of September.

In the lowest cellar eight only had left the water, being fully developed on the 20th of October.

In the following year, July 1st, I made a similar experiment in the same cellars, three weeks later. The tadpoles were of a large size. I obtained the same result—the full development of the frog in the absence of light; but in this experiment I had another object in view, that of observing the growth and obtaining the exact weight of the tadpoles before, during, and after their metamorphosis into a frog.

Dr. Edwards said that in his experiment “the tadpoles attained an extraordinary size, doubling or trebling their usual full weight;” but he unfortunately does not mention any particular weight, or how long the tadpoles were preserved alive; in fact there is nothing definite.

During my several years of experiments I did not observe any remarkable increase of weight or size as mentioned by Dr. Edwards, although my first experiment was from the ovum to the full development of the frog, and the two last when the tadpoles were approaching the period of their development.

In my first experiment on the ovum, I never obtained a tadpole more than 8 grains in weight in the absence of light; but I found in a pool in the neighbourhood a number of tadpoles, some between 11 and 15 grains in weight; seven of them weighed 15 grains each. Of these large tadpoles I took twenty for my experiment, weighing altogether 264 grains, and averaging about 13 grains each. After their transformation the frogs weighed 93 grains, averaging about $4\frac{1}{2}$ grains each,—those of 15 grains in the tadpole state only weighing 5 grains as frogs, having lost two-thirds of their weight during their metamorphosis.

Subsequent experiments have been in accordance with the above.

ZOOLOGICAL SOCIETY.

Nov. 12, 1862.—Dr. J. E. Gray, V.P., in the Chair.

The following extract from a letter addressed to the Secretary by Edward Blyth, Esq. (Corr. Memb.), dated Maulmein, May 10th, 1861, was read to the meeting:—

“I have made this day a grand discovery, which neither you nor others will believe in at the first announcement, but it is true nevertheless,—viz. that the extraordinary Rhinoceros-horn figured * as that of *Rhinoceros Crossii* by Gray, in your ‘Proceedings,’ is the well-developed anterior horn of an old male *R. sumatranus*—the common species of these provinces. My host at this place is a great sportsman, and some noble trophies of the chase hang in his verandah; but what fixed my attention was the head of *R. sumatranus*, with a development of horns which I had never imagined to occur in this species; and the resemblance of the much-curved anterior horn to that of Gray’s supposed species, *R. Crossii*, struck me at once. Conversing with my host on the subject, he remarked that he took a similar head to England (where it now adorns his family hall), with the front horn at least 3 inches longer, and still more curved. A little reflection, and I felt satisfied that *R. Crossii* must sink into a synonym of *R. sumatranus*.”

In a subsequent communication Mr. Blyth remarked:—

“All doubts now removed about the identity of *R. sumatranus* and *R. Crossii*. Mason states that the skin of the Tenasserim species ‘is quite smooth, like a buffalo’s’—meaning devoid of folds; but Col. Fytche assures me that the one he shot had the slight folds described and figured of *R. sumatranus*. The mature female horns are small, and the nasal bones comparatively narrow; I am not aware that a corresponding sexual difference occurs in any other Rhinoceros. In the Indian one-horned species the sexes are alike in size and development of horn.”

The following papers were read:—

NOTICE OF HELOGALE, A NEW GENUS OF VIVERRIDÆ.

By DR. J. E. GRAY, F.R.S., V.P.Z.S., F.L.S., ETC.

In making out a list of the skulls of the animals in the Museum, Mr. Edward Gerrard called my attention to a peculiarity in the skull of some of the smaller African Mangoustes. They are externally like the true *Herpestes*, but they want the smaller false premolar teeth in the upper jaw, which are always to be found in the true species of that genus. I propose to designate the group *Helogale*, which may be thus characterized:—

HELOGALE.

Cutting teeth $\frac{3-3}{3-3}$; Can. $\frac{1-1}{1-1}$; Premol. $\frac{3-3}{3-3}$; Mol. $\frac{2-2}{2-2} = 36$.

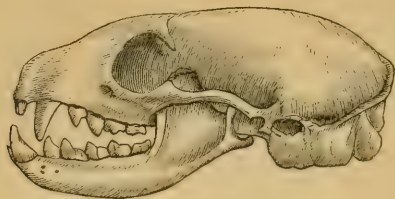
* See P. Z. S. 1854, p. 250.

Body slender ; head oval ; ears distant ; toes 5—5 ; claws compressed, acute ; soles of hind feet half bald and callous ; tail hairy, tapering.

1. *HELOGALE PARVULA* (*Herpestes parvulus*, Sundeval).

Skull broad.

Hab. Natal.



Skull of *Helogale parvula* (side view).



Skull of *Helogale parvula* (upper surface.)

2. *HELOGALE TÆNIONOTA* (*Herpestes tænionotus*, A. Smith).

Skull elongate.

Hab. South Africa.

The skull differs considerably in shape from that of the species of true *Herpestes*.

ADDITIONAL OBSERVATIONS ON THE GENUS *CUSCUS*.

BY DR. JOHN EDWARD GRAY, F.R.S., V.P.Z.S., ETC.

In the 'Proceedings' for 1858, p. 100, I gave some observations on the genus *Cuscus*, with the description of a new species ; and in the volume for 1860, p. 1, I described another species of the genus*.

Since that time we have received several additional specimens from Mr. Wallace, and I have also been able to examine many other examples sent home by the same excellent collector ; the examination of these specimens has induced me rather to modify my views as regards the species, and has led me to observe other characters for the species which were before unknown to me.

I therefore lay before the Society these additional observations, in the hope of doing something towards settling the species of this very difficult group of animals, which are curious as being the only

* See Annals, vol. ii. p. 67, and vol. vi. p. 65.

Marsupials that have as yet been submitted to a kind of domestication; though I have never been able to see why Kangaroos might not have been domesticated by the Australian emigrant, except from the difficulty of making them adopt new ways even in a new country.

I may observe that I believe the British Museum contains the largest and finest collection of specimens of this genus that has ever been brought together. A few years ago we considered ourselves fortunate in having two specimens; now we have thirty-three from very different localities, and I have besides these examined about half as many more.

The zoologists of the modern school are very desirous that the name of the original namer of the species should always be inserted after the specific name, to show to whom belongs the honour of having first named the species,—often a very doubtful source of congratulation or proof of scientific attainment, as for example in this genus.

Should the various coloured varieties really be proved to be good species in this genus, we shall have to adopt the names of Lesson, an author who seems only to have seen a very few specimens, and to have applied a name to each of those that he saw, without giving himself the trouble to ascertain what were the characters that separated them from the other examples of the genus; and it is frequently the case, not only with species but with genera, that the man who first gives the name to either one or the other often knows less about them, and takes less trouble to study the subject, than men who have never given a new name to either genus or species. This was specially the case with Swainson, who has given the names to many genera of shells and birds even on the slightest characters, and without the least analysis.

In my former paper I divided the *Cusci* into two sections, according to the hairyness and prominence of the ears; I will now divide them into four sections, according to the form of the skull and the number and disposition of the anterior false grinders; and thus place at the disposal of the student two means of determining the species.

Sect. I. The nose of the skull short, broad, and rounded. The anterior conical false grinders one on each side, large, and nearly filling up the short diastema. The grinders large, in an arched series, converging behind. The forehead of the skull rather swollen over the front, and depressed between the hinder part of the orbits. Ears hidden under the fur. Fur of one colour. *EUCUSCUS*.

1. *CUSCUS* (E.) *URSINUS*, Gray, P. Z. S. 1858, p. 103.

Temm. Monog. t. 1. f. 1, 2, 3 (adult), t. f. 1-5 (half-grown) (skull), t. 4 (skeleton).

Blackish; tail and rump dark, like back.

Hab. Celebes (*Temm.*).

The three skulls, of different ages, all show only a narrow linear space between the upper edges of the masseter muscles. The fore-

head of the youngest specimen is not so concave as that of the two older ones.

We have an adult and half-grown female from Celebes, obtained for the Leyden Museum in 1843; and a nearly adult specimen without any distinct indication of its sex—probably a female—with the pouch sewed up, from the Zoological Society, 1855.

If this should be the case, we have only female specimens of this genus; but I believe they have a male at Leyden.

2. CUSCUS (E.) BREVICAUDATUS, Gray, P. Z. S. 1858, p. 102.

Pale brown; the tail and rump of the same colour as the back.

Hab. Cape York (*Mr. Macgillivray*).

The skull, which is that of a very young animal, is more like that of *C. ursinus* than that of any other species in our Collection.

The canines are close to the cutting-teeth, and with a very small space between it and the first grinder. The skull is rather convex, and swollen in front over the orbits.

We have only the young specimen and its skull, on which Mr. Gould established the species. It seems very distinct from *C. ursinus*.

Sect. II. The nose of the skull rather produced, rounded. The anterior conical false grinders one on each side above, moderate-sized, near the middle of the broad diastema. The grinders in a slightly arched series. The forehead very convex, rounded over the middle of the orbit, and flat behind. The ears hairy outside, hidden in the fur. The fur more or less variegated. Tail pale or yellowish. Dorsal streak none. *SPILOCUSCUS*.

The skulls which we have of the animals of this section show that there are probably two distinct species. One species has grinders of a rather larger size than those of *C. ursinus*, but differing from them in being in only a slightly curved line, the three first grinders forming a series of from 10 to 10½ lines, or twelfths of an inch. In this respect the skull agrees with those figured by Temminck (*Mon. Mam. t. 3. f. 1-6*) as of *Phalangista maculata*. But one skin agrees with the description of the skin of *P. chrysorrhos* of that author, and its teeth with the figure of the teeth of *P. maculata*. Yet it is to be recollected that this author had only a very small number of specimens to examine, and he does not mention in his description of either species the difference in the size of the grinders, though he shows the difference in his figures.

The second species has smaller grinders, placed in the same manner as the former,—the three front grinders forming a series of from 8½ to 9 lines in length, as they are figured by Temminck (*Monog. t. 1. f. 4-6*) as *Phalangista chrysorrhos*.

We have two skulls with their skins belonging to this kind; and both have the spotted skins which Temminck calls *Phalangista maculata*. Under these circumstances it is difficult to adopt Temminck's name. Are we to take those of the skin or those of the skulls? Perhaps what he describes as *C. chrysorrhos* may be the proper and wild state of each species, and the spotted varieties de-

scribed as *C. maculata* may be albino varieties or half-domesticated varieties of them, for the natives of some islands are said to breed them.

As I have not the power of examining the skulls of all the specimens, I have arranged those in the Museum provisionally under these two names, taking them as they designate the general colour of the fur.

3. *CUSCUS* (S.) *CHRYSORRHOS*.

Cuscus maculata, var. 1, 2, Gray, P. Z. S. 1858, p. 102.

Phalangista maculata, Temm. Mam. t. 2. f. 1-5 (adult), 6 (young skull).

The grinders * large, three front of from 10 to 10½ lines in length.

Fur dark grey-brown; sides and middle of the back blacker or black; face reddish; rump and tail yellowish; belly white.

Var. *albina*?

White; feet and large spots on back red-brown.

Hab. Ceram; south coast of New Guinea; "Moluccas" (Temm.).

1. An adult female of a large size from the Leyden Museum as *C. chrysorrhos*, Temm. 1859.

2, 3. An adult and a three-fourths grown female, with the sides very deep black. From Ceram; Mr. Wallace, 1859.

4. A young female specimen from the south coast of New Guinea; J. B. Jukes, 1846.

The skull of this animal shows that it belongs to the large-toothed species.

Var. ? *albina*. White, reddish varied.

C. maculata, nos. 3-5, Gray, P. Z. S. 1858, p. 102.

5. White, with a long irregular patch on the back, and the four feet red. A female from Dufour Island, south-east coast of New Guinea; John Macgillivray, 1851; and its skull, which agrees with Temminck's figure of the skull of *C. maculatus*.

6. ? An adult male, with numerous confluent reddish spots. New Guinea; John Macgillivray, 1855.

7. ? A half-grown male, with numerous small, reddish and dark-brown spots, often confluent. Darnley Island, south coast of New Guinea; John Macgillivray, 1855.

I have not been able to examine the skull and teeth of these specimens; so they may belong to the next.

4. *CUSCUS* (S.) *MACULATUS*.

Cuscus maculatus, Lesson, Voy. Coq. t. 5.

Cuscus maculatus, var., nos. 3-7, Gray, P. Z. S. 1858, p. 102.

* I give the measurement of the three first of the true grinders only, because in the young skull the hindmost grinders are not developed. I may state that the difference in the size of the grinders does not depend on the sex of the species, as there are both males and females with teeth of each size.

Phalangista chrysorrhos, Temm. Mon. t. 1. f. 4, 5, 6 (skull, not skin).

Grinders moderate, three front forming a series of from $8\frac{1}{2}$ to 9 lines in length. Skull very convex on the front of the orbit, flat or slightly concave behind the convexity, the temporal ridges close together, united (in the adult skull) and forming a sharp ridge.

White, spotted with fulvous grey-brown or black; forehead reddish.

Hab. New Guinea. Waygeroo and Aru Islands.

There are both sexes in the Museum Collection.

1. Adult male. Spots on the head and shoulders, confluent on the back and sides, small, scattered; tail white. Waygeroo. Purchased of M. Verreaux, 1856, as *Cuscus maculatus*.

2. Adult male. White, with numerous, scattered, small spots; tail white, slightly varied with pale reddish. Aru Island; Mr. Wallace, 1857. This belongs to the smaller-toothed kind.

3. Adult male and female. Very similar; yellowish white spots, numerous, smooth, intense black; head reddish-brown; tail white, marbled with pale reddish. Waygeroo; Mr. Wallace, 1860.

Mr. Wallace observes that these animals are diurnal: the female he marks as having a pale hazel iris. The skull of the male shows that it also belongs to the smaller-toothed kind.

The three skulls in the Museum agree with the above description, but vary among themselves; one of the skulls from Aru (1195 *b*) is much narrower in all its parts, and is less swollen and narrower between the orbits, than the others from the same locality, and is probably the skull of a female, as 1195 *a* is from the male specimen sent from Aru by Mr. Wallace.

The skull of the male specimen sent by Mr. Wallace from Waygeroo is similar to the male from Aru (1195 *a*), but is rather more swollen, especially between the front of the orbits.

Sect. III. The nose of the skull rather produced, rounded. The anterior conical false grinders one on each side above, moderate-sized, near the middle of the broad diastema. The forehead deeply concave, with a raised edge on each side between the orbits. Ears naked within, extended beyond the fur of the head. Fur of body and tail uniformly coloured, with a dorsal streak. STRIGOCUSCUS.

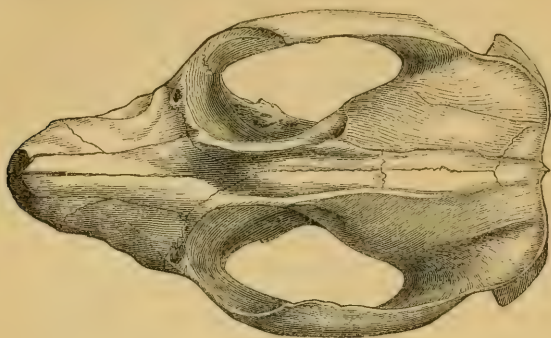
5. CUSCUS (S.) CELEBENSIS, Gray, P. Z. S. 1858, p. 105, t. 62.

Hab. St. Cristoval, Solomon's Group of Islands.

We have both sexes in the British Museum Collection, and the skulls of two others nearly adult, collected by Mr. Rayner and Mr. J. Macgillivray during the voyage of the 'Herald.' There is very little difference between the two skulls, though they are from a male and female animal.

In the description of the species in the paper above referred to, the animal is erroneously said, by a slip of the pen, to have no dorsal streak.

We have in the British Museum a young specimen of a *Cuscus* from Macassar, which is very like *C. celebensis*, but it has no visible dorsal streak: it is not in a very good condition. It may be a variety of this species, or the young of one of the other, or perhaps an undeveloped state of a new one.



Skull of *Cuscus celebensis* (upper surface).



Skull of *Cuscus celebensis* (side view).

Sect. IV. The nose of the skull rather produced, rounded. The anterior conical false grinders *two* on each side above, the anterior rather larger, the hinder very small, cylindrical; both near the other grinder, and widely separated from the canines. The forehead with a deep concavity between the orbits. Ears naked within, extended beyond the fur of the head. Fur on body and tail uniformly coloured, with a dorsal streak. *CUSCUS*.

6. *CUSCUS ORIENTALIS*, Gray, P. Z. S. 1858, p. 104, t. 61.

Cuscus Quoyii, Lesson in Quoy & Gaim. Voy. Uranie, Zool. t. 56. f. 6.

The male and female grey brown, with a distinct dorsal streak.

Var. *albina*?*Cuscus orientalis*, Temm. & Gray.

Males pure white, without any dorsal streak.

Hab. Islands of Waigiou and Ceram.

Mr. Wallace attached to the male species this observation: "the claws, soles, and end of the tail nearly white; eats leaves and cocoa-nuts (young)." He calls the male *C. orientalis*.

We have specimens of both sexes in the Museum; a very young and adult female from Waigiou, obtained from M. Verreaux in 1856; and male and female, with two young from the pouch, from Waigiou, and a male from Ceram, from Mr. Wallace, in 1859 and 1860.

In the skull of the female the temporal ridges are separated from one another by a wide flat band.

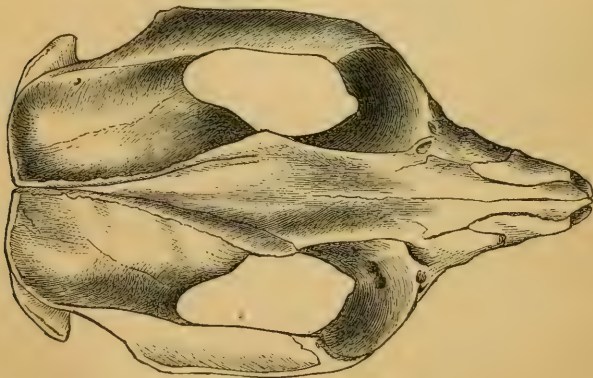
Temminck, and other authors since his work, have described the male of this animal as white, and the female as silver-grey with a black dorsal streak; but we have both sexes of the latter colour. Can the white males be an *albino variety*, and confined to the male sex? We have two full-grown males of that colour, one obtained from Leyden Museum, said to come from Amboyna, and another from M. Verreaux, said to come from New Zealand; they both have the small hinder false grinders.

7. CUSCUS ORNATUS, Gray, P. Z. S. 1860, p. 1, pl. LXXIV. (male).

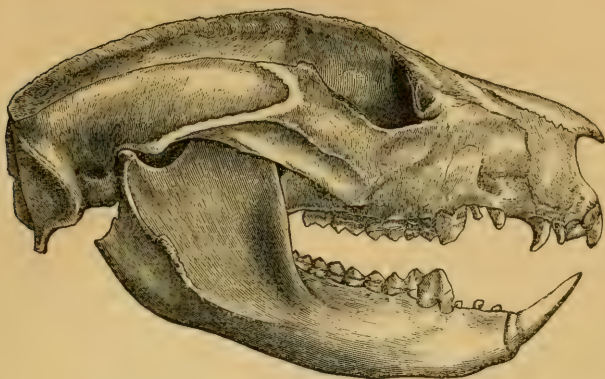
Both sexes grey-brown, grised, and marked with small white spots and a distinct dorsal streak; the ground-colour of the male is yellowish-red, of the female dark grey-brown.

Hab. Ternate and Batchian (*Wallace*).

We have a male and three females in the British Museum, all from Mr. Wallace—a male from Batchian in 1859, two adult and a young female from Ternate, obtained in 1858 and 1859.



Skull of *Cuscus ornatus* (upper surface).

Skull of *Cuscus ornatus* (side view).

In the British Museum there are two young specimens of the genus which I am not able to determine with certainty. They are both of a fulvous-brown colour, and without any streak on the back.

1. Said to come from "Amboyna," and is supposed to be a young *C. orientalis*; the sex is doubtful, but probably a male.

2. The other was sent by Mr. Wallace from Macassar in 1857, and is a young male. I formerly considered it as a variety of *C. celebensis* (P. Z. S. 1858, p. 43); and it is like that species in several particulars; but the want of the dorsal streak is a great peculiarity, which was not so distinctly seen before it was stuffed.

ON THE OPHIDIANS OF THE PROVINCE OF BAHIA, BRAZIL.

By DR. OTHO WUCHERER, CORR. MEMB. (Part II.*)

Of the family of *Coronellidæ* several species of *Liophis* are very common in this province—*Liophis cobella*, *L. Merremii*, *L. reginæ*, and *L. conirostris*. The last appears to me to occur only in the vicinity of the city of Bahia. In several collections of Ophidians sent to me from different parts of the province, I never found a single specimen, whilst it is rather common in the vicinity of the city of Bahia. It never attains to the same size as the other species. Some specimens of *L. Merremii* show so constantly certain differences from others, that I feel tempted to consider them as belonging to a distinct species, particularly as those differences are by no means referable to the different age of the individuals; however I shall withhold my suggestions until I shall have collected more materials to substantiate them. *Erythrolamprus venustissimus*, of the same family, is not unfrequent. It shares with different other snakes the Portuguese name of *Cobra Coral*.

* See Annals, vol. viii. p. 179, for Part I.

The species of the genus *Xenodon*, which have been referred to the family of *Natricidæ*, are allied to *Liophis* in many respects. Their dentition is very similar; they may all be considered as fresh-water snakes (some species of *Liophis* are called by the Brazilians *Cobras d'agua*), although they are frequently found in dry places and at a distance from the water. They all live on Batrachians, and have this peculiarity in common with the other snakes of the family of *Natricidæ*, that they do not squeeze their prey to death before swallowing it, nor ever coil themselves around it.

I have noticed only two species of *Xenodon*—*X. rhabdocephalus* and *X. colubrinus*.

In a preliminary list of snakes observed by me, given by Dr. Albert Günther, *X. severus* is mentioned; however, on a repeated examination of the specimens in my possession, I must refer them all to *X. rhabdocephalus* *. This is a very common species in Bahia. Several young examples may be frequently found together. It is very lively and courageous, and, on account of its broad head and rather vicious appearance, much dreaded by the Brazilians, who give it the name of *Surucucú*. In order to distinguish *Lachesis mutus* from it, they call the latter *Surucucú bico de jacca*, from the resemblance of its strongly keeled scales to the prominences on the Jackfruit—the fruit of the *Artocarpus integrifolia*. This *Xenodon* is very voracious. Recently I had a young living specimen of it in the same cage with one of *Liophis conirostris*, and gave them two young *Cystignathi fusci* for their food. The *Xenodon* immediately seized one of the frogs by the snout; but the *Liophis* did not succeed so well with the other frog, and found it easier to seize the *Xenodon's* prey by the hind legs. A struggle commenced, in which the *Xenodon* had better hold of the frog than the *Liophis*, and, the latter being obstinate and not inclined to relinquish its hold, began to encompass its head with its wide jaws. It became evident that the *Liophis* would have to share the fate of its intended victim. As it was the first living specimen of its species I had been able to obtain, I was very anxious to save its life; so I cut the *Xenodon* in two with a knife, and the *Liophis* quickly passed through the anterior segment of the *Xenodon's* body with the frog. The *Liophis* was returned to its cage, when it directly seized hold of the other frog, and swallowed it undisturbed. It had along its head, neck, and anterior part of the body minute wounds from the *Xenodon's* teeth, which bled freely while it was engaged in swallowing the frog; but it has done quite well since, and I hope it may arrive safely at the Gardens of the Society.

It is surprising how broad and flat a *Xenodon rhabdocephalus* makes itself at times, chiefly whilst basking in the sun. This is owing, I suppose, to a peculiar conformation and attachment of its ribs, which I have not yet examined. The species of *Liophis* never make themselves so broad. A *Xenodon* can pass a crevice which is exceedingly small in proportion to the width of its head,—one smaller than that which a *Liophis* with a much thinner body can pass.

* One specimen of *X. severus* in the Collection of the British Museum is mentioned in the Catalogue as derived from Bahia.

Of the interesting species *Xenodon colubrinus*, so well established and happily named by Dr. Albert Günther, I received several live specimens from Ilhéos. When irritated, it rapidly strikes the ground with its tail—a habit I have also noticed in *Spilotes variabilis*, *S. pæcilostoma*, *S. corais*, and in *Coryphodon pantherinus*. In its habits it resembles also *X. rhabdocephalus*; but in the form of its head it shows great similarity to the members of the next family—that of *Colubridæ*. In this species I first noticed a bright white spot or groove on the tip of each scale. Recently I have become indebted to Dr. A. Günther's kindness for a perusal of Prof. Reinhardt's interesting paper on these curious spots or depressions*. Reinhardt discovered them during his stay in Brazil, about thirteen years ago, in a living specimen of *Philodryas Olfersii*—a snake which has not yet been noticed by me. After his return to Europe he found them in preserved specimens of many other Ophidians, and has tried to vindicate for them the importance of a classifying character, which they undoubtedly possess. Reinhardt mentions that these depressions had been noticed before by Wagler in species of *Xenodon*, by Holbrook in *Coluber alleghaniensis*, and by Günther in West Indian species of *Dromicus*, but that they had been overlooked by other herpetologists. In *Xenodon colubrinus* they are remarkably distinct, clearly perceptible with the naked eye; they are circular, and placed very near the tip of the scales.

The family *Colubridæ* is represented by two genera in this province—*Spilotes* and *Coryphodon*.

Coryphodon pantherinus is exceedingly common. The grooves on its scales are double, as in all the other species of this family, with the exception of *Zamenis Dahlia*, Fitz., which, according to Reinhardt, has scales with a single groove. Reinhardt, however, observes that this Ophidian had been classed by Schlegel with the *Psammophidæ*, which have scales provided with a single groove.

Of the genus *Spilotes* I have noticed *S. corais*, *S. pæcilostoma*, and *S. variabilis*.

They are very similar in their habits, very bold; and the most undaunted is perhaps *S. corais*. It is called by the Brazilians "*Papa-pinto*," from its averred predilection for chickens, of which circumstance I have never been able to satisfy myself. It frequents the neighbourhood of rivers, where it often strikes terror into the black washerwomen occupied at their calling, by approaching and running after them. I have been told strange stories about its creeping on to the beds of sleeping women who nurse, and sucking at their breasts. It may be that, like many other reptiles, it is very fond of milk; and this may account in part for such tales, which have been current in other countries also. *S. corais* has generally seventeen rows of scales; but I have seen several specimens with only fifteen rows. One very large specimen from Caravellas in my possession, which measures 8', has nineteen rows of scales. The other two species of *Spilotes* are both called "*Cainana*;" the

* See p. 255 of our present Number.

grooves on their scales differ from those of *S. corais* in being larger and oblong or elliptical. I was on the point of referring a specimen of *S. corais*, with fifteen rows of scales, to *Herpetodryas dendrophis*, on account of the slender form of its head; but the presence of the two depressions on each of its scales assisted me in its correct determination. With regard to *S. variabilis*, I must state that the specimens examined by me, which were all adults, had no loreal shield.

The *Dryadidæ* I have met with belong to two genera, *Herpetodryas* and *Philodryas*. *Herpetodryas carinatus* is one of the most common snakes in this province. The Brazilians call it, as well as all the other slender species of snakes, "*Cipo*," which signifies the stem or a stick of a creeping-plant. Before I had read Schlegel's 'Essay,' I referred all the specimens of *Herpetodryas* in which I did not detect any keeled scales to *H. fuscus*, this being the only distinctive character given in Günther's Catalogue. When I found that Schlegel had not admitted *H. fuscus* as a separate species, I submitted all my specimens (several dozens) to a closer examination, and found that there was not a single one in which at least very slight traces of keels were not to be found in some scales; so that I feel inclined to follow Schlegel, and to consider my specimens as belonging to one species. According to Reinhardt, the scales of *Herpetodryas carinatus* are without any groove,—an observation with which I cannot agree, having found grooved scales in all my specimens. In some specimens they were found, indeed, only on a few scales of the neck near the head; others had them on the two middle rows of keeled scales. The occurrence of these grooves in *Herpetodryas** is very interesting, particularly because they are single, and not double as is generally the case in keeled scales. They are placed near to the inner edge, and at the point of junction of the distal with the middle third of the scale. They are proportionately smaller in larger specimens. The largest specimen noticed by me is 5 feet 7 inches long.

Philodryas viridissimus is not quite so common as the last species. The largest specimen I have seen measured 4 feet. Reinhardt found two grooves in the scales of this snake. After a careful search, I cannot find more than one groove at the tip of the scales. Some scales on the tail have certainly two grooves, evidently in consequence of the confluence of two scales.

Philodryas Schottii.—I obtained a single specimen in a bad state.

Of the family of *Dendrophidæ* I have seen a single specimen of *Ahætulla liocerca*†: it must be a very beautiful snake. It is said to be exceedingly lively; and this, with its proportionately long teeth, may be the cause of its being considered dangerous by the Brazilians.

* I have examined several specimens of this species: I was unable to find these grooves in *H. carinatus*; one specimen of *H. fuscus* showed a single groove on a few scales on the neck.—A. G.

† I received it from Mr. Christopher Gayleard, whose unceasing kindness in assisting me to collect specimens I am happy to acknowledge.

The family of *Dryophidæ* has two representatives in Bahia, belonging to the genus *Dryophis*—*D. argentea* and *D. acuminata*. The former is very scarce (I have seen only one specimen in Mr. C. M. Föppel's collection), the latter very common.

MISCELLANEOUS.

On some small Pits with which the Scales of certain Ophidia are adorned. By J. REINHARDT.

It is about twelve years since, during his residence in Brazil, M. Reinhardt observed small whitish and brilliant points scattered over the body of the green snake, common in that country, to which Lichtenstein gave the name of *Coluber Olfersii*, and which Wagler has adopted as the type of his genus *Philodryas*. Careful examination showed M. Reinhardt that each scale of this snake is furnished, close to its posterior extremity, with a small depression or pit, of which the brilliancy is greater than that of the rest of the scale. These impressions cease at a little distance from the point of the tail. They are also wanting in the anterior part of the body, on the two rows of scales nearest to the ventral plates, and even, further back, on three or four ventral rows. At the root of the tail there are not more than six rows of scales furnished with pits; this number soon falls to three, and a few inches further on there are only two.

When the epidermis is carefully removed from some of the scales furnished with pits, and examined with the lens, it is found that no opening exists corresponding with the pits. The epidermis is only very delicate at this point, and as transparent as glass. Nor is any aperture to be found in the pit of the cutis, and consequently there is no canal or cavity leading into the interior of the scale.

M. Reinhardt was naturally led to compare other Ophidia with the *Philodryas* with regard to this peculiarity. Amongst 191 species examined up to this time, he has found pits in 106. The frequency of these little depressions is undoubtedly still greater than might be assumed from the above numbers. In fact, M. Reinhardt has examined comparatively a greater number of species of groups not furnished with pits than of those which are provided with them.

In many species the pits are as large as, or larger than, in *Philodryas*, and then they are easily recognizable by the naked eye. Often, likewise, they are smaller, and cannot well be distinguished except with the lens. Sometimes there is only one upon each scale, sometimes there are two. In the *Ophidia* with smooth scales, the species with one and those with two pits are nearly equal in number. In the *Ophidia* with keeled scales, the pits, when they exist, are almost always two in number on each scale, placed one on each side of the keel. Some species, however, have only one.

The function of the pits is still unknown. They are not connected with any gland, and never constitute a sexual difference. They may

nevertheless be employed as a check upon herpetological systems. The classification of Duméril and Bibron, founded essentially upon the dentition, establishes groups which by no means coincide with the absence, presence, or number of pits on the scales. M. Reinhardt considers this classification as essentially artificial. He admits that within certain limits the dentition has an incontestable systematic importance, but he does not think that it can be regarded as a character ruling all others. All the attempts hitherto made at classifying Serpents in accordance with the dentition alone have led to the approximation of very diverse species, and to the separation of allied forms. On the other hand, M. Reinhardt considers the groups established by Schlegel under the name of genera as very natural. He thinks that the system of that author is the best in the present state of science, provided the modifications proposed in 1858 by Dr. Günther, in the 'Catalogue of Ophidia in the British Museum,' be adopted. There are, no doubt, exceptions; but we find entire families with two pits, others with only one, and others which are destitute of them. Moreover, the families in which all the species exhibit a uniformity of character in this respect are generally very natural families.

M. Reinhardt himself does not ascribe an exaggerated importance to the pits in question. He does not dream of making use of them as the basis of a classification. But it is interesting to find, in a peculiarity apparently so useless, a confirmation of the establishment of certain families; and it may also serve occasionally to determine the probable affinity of an Ophidian whose position is doubtful.—*Bibl. Univ.* Jan. 20, 1862, *Bull. Sci.* p. 78.

Note on Callithamnion Rothii. By G. S. BRADY.

The influence of external circumstances in introducing changes of species, and the range of altered conditions which individual species are qualified to bear without change or death, is a matter which seems as yet to be very imperfectly understood, notwithstanding that it lies near the root of much that has recently been written respecting the succession of life on the earth. Viewed in this light, the following remarks on one of our native Algæ may not be without interest.

In February of last, and June of the present year, I observed that certain stones near the mouth of a cave, a little north of Hawthorne Dene, were covered with a red velvety fleece, which on examination proved to be *Callithamnion Rothii*, one of the smallest of the Rhodospiræ, its filaments seldom much exceeding half an inch in length. The stones thus coated with the *Callithamnion* were exposed to a heavy dripping of fresh water from the roof of the cave (not merely a scanty fall of drops, few and far between, but a copious pelting, sufficient to wet one very unpleasantly while gathering specimens), and beyond the area of this dripping the plant did not extend. The mouth of the cave is not very far below high-water mark; and I should judge that in this position the plant must be exposed to

alternations of about four hours' washing with sea-water, and eight hours' with fresh. I have met with no other instance of a *Callithamnion* growing under exposure to fresh water; and when *C. Rothii* is found (as is often the case) on rocks near high-water mark, it is almost always so stunted as to amount to little more than a red film or crust, in which state it constitutes the *Byssus purpurea* of old authors*. In the Hawthorne locality, however, it attains a size larger than usual even in favourable situations; so that the fresh water cannot be supposed to exercise any prejudicial influence on its growth. Now, it so happens that there is another genus described by algologists (*Trentepohlia*), which, according to Professor Harvey, differs from *Callithamnion* in no other respect than its *fresh-water* habitat. Indeed, in the first edition of his 'Manual of the British Algæ,' he remarks "that *C. Daviesii* and *T. pulchella*, when the latter is well coloured, are scarcely distinguishable under the microscope." It seems to me that the Hawthorne plant goes a great way to establish Dr. Harvey's view of the identity of the two genera; for, though exposed for about sixteen hours out of twenty-four to the influence of fresh water, it is certainly referable to the marine species *Callithamnion Rothii*, and at the same time is undistinguishable, so far as I can gather from figures and written descriptions, from the fresh-water species *Trentepohlia pulchella*. There is nothing exceptional in the case of a plant growing indifferently either in salt water or in fresh. The common *Enteromorpha intestinalis*, a marine species, flourishes in streams, ponds, and ditches quite away from sea influence. *Bangia fusco-purpurea* has been found in like circumstances; and even with animals, instances of a similar tolerance might be brought forward. In short, it seems quite unphilosophical to separate plants which are to all appearance precisely similar, merely on account of a difference in habitat; for what does such a circumstance show, more than that a single species possesses the capacity of existence under widely different conditions?—*Trans. Tyneside Naturalists' Field Club*, 1861.

Vitality of the Seed of Fumaria muralis (Sonder) and Hyoscyamus niger (L.) By the Rev. ALFRED MERLE NORMAN, M.A.

The ancient churchyard of Embleton, in the parish of Sedgfield, was surrounded by a very old hedge, which, last year, when the church was rebuilt, was grubbed up. Upon this freshly turned-up ground—earth which had not been disturbed for centuries—there sprung up in profusion two interesting plants, *Fumaria muralis* (Sonder) and *Hyoscyamus niger* (L.). What makes the circumstance the more

* *Byssus purpurea* is noted by Mr. Winch as occurring "on rocks and stones in alpine situations." Assuming that the plant alluded to is the same as that found on rocks with marine exposure (which, though evidently inferred by Mr. Winch, is perhaps reasonably open to doubt), there seems the less reason to hesitate in uniting the two *aquatic* forms. But, without further evidence of the identity of the two *terrestrial* plants, it is impossible to push this argument.

remarkable is the fact that this is the first and only instance in which I have met with either of the Capreolate *Fumaricæ* in the neighbourhood, notwithstanding that they have been closely looked for. Such instances of the vitality of seeds are not unfrequent, but are always interesting, and offer some problems well worthy of solution. Why had not these seeds previously germinated? Perhaps because they were too deeply buried in the ground. But if this be so, at what depth do seeds cease to vegetate, and what is the influence which, acting on the germ, keeps in abeyance the vital energy stored up within?—*Trans. Tyneside Naturalists' Field Club*, Jan. 1862.

Highly interesting Discovery of new Sauroid Remains.

Mr. O. C. Marsh, a student in the Sheffield Scientific School of Yale College, U.S., procured last summer from the coal formation of the Joggins in Nova Scotia, where he has for several seasons spent his long vacation in mineralogical and geological observations, two Saurian vertebræ, of which Agassiz writes to us thus:—

“*My dear Silliman*—A student of your Scientific School, Mr. Marsh, has shown me today two vertebræ from the coal formation of the Joggins, which have excited my interest in the highest degree. I have never seen in the body of a vertebra such characters combined as are here exhibited. At first sight they might be mistaken for ordinary Ichthyosaurus vertebræ; but a closer examination soon shows a singular notch in the body of the vertebra itself such as I have never seen in Reptiles, though this character is common in Fishes. We have here undoubtedly a nearer approximation to a *synthesis between Fish and Reptile* than has yet been seen. * * * *
The discovery of the Ichthyosauri was not more important than that of these vertebræ; but what would be the knowledge of their existence without the extensive comparisons to which it has led? Now these vertebræ ought to be carefully compared with the vertebræ of bony Fishes, with those of Sauroid Fishes, of Selachians, of Batrachians, of the Oolitic Crocodilians, of the newer Crocodilians, of the Ichthyosaurians, and of the Plesiosaurians, and all the points of resemblance and difference stated; because I do not believe there is a vertebra known, thus far, in which are combined features of so many vertebræ, in which these features appear separately as characteristic of their type. Whatever be the fate of these remains, be sure that they are preserved where nothing can happen to them, and where they will be duly appreciated.

“Ever truly yours,

“L. AGASSIZ.”

“Museum of Comparative Zoology, Cambridge, U.S., Dec. 23rd, 1861.”
—*Silliman's Journal* for January 1862.

Discovery of Saurian Remains in the Keuper of the Jura.

In making a section for the railroad now in construction in the neighbourhood of Poligny, remains of a gigantic Saurian have been

discovered. With great care and precaution the following fragments were obtained :—three claws of eight to twelve centimetres in length, several other phalanges with fine articular surfaces, a part of the tarsus and metatarsus, two vertebræ joined, and several other fragments. The dimensions of these bones is such that the whole length of the animal cannot have been less than from thirty to forty metres. [?]

These remains lay in the upper strata of the Keuper, visibly overlapped by the lower Lias. These formations have heretofore been considered as devoid of organic remains in this country (France) where they contain gypsum and rock-salt. Nevertheless, some years ago, M. Pidancet, a geologist of the Franche-Comté, found in these same strata large bones, which he deposited in the museum of Besançon, and which he considers as belonging to the same species. Besides, a few months ago, near Domblans, while opening a ditch for the railroad, a similar fragment was found; and M. Lauckardt, one of the employés, has seen at the same place other bones, much larger, which he could not remove on account of their fragility.

Another discovery, not less important, was made by M. Froment, mayor of Saint Lothaire, in strata younger than the Keuper formation. The bones found there belong to the *Elephas primigenius* and to a kind of Stag; among them are two molar teeth beautifully preserved. This deposit of bones is in a layer of sand and marl containing boulders of quartz and numerous fragments of terrestrial and fresh-water shells, but no trace of human remains.—*Silliman's Journal* for January 1862.

On the general conditions of the Avicula contorta Beds, and on the constitution of the Infra-Liassic stage. By ANT. STOPPANI.

The little fossil which bears the name of *Avicula contorta* was scarcely known a few years ago. General Portlock first named it, in 1843, after his geological investigation of a part of Ireland. By degrees this fossil has acquired great importance, which is due to its abundance, and to the extent of the beds in which it has been deposited.

The first part of M. Stoppani's memoir contains a historical summary of the investigation of the beds which occur on the horizon of the *Avicula contorta*, the description of the characters of these beds, and the indication of their thickness, which appears to be but small in England, about 12 metres on the northern slope of the Alps, and from 800 to 1000 feet in Lombardy. As regards their extent, they are known in Ireland and England, in Würtemberg and Bavaria, in Westphalia, Luxembourg, and the departments of the Moselle, of La Meurthe, of the Côte d'Or, de l'Yonne and of the Rhone, in the Cevennes, in Savoy, in Switzerland, in the Vorarlberg, and at other points of the chain of the Alps as far as Hungary. Throughout, these beds form a convenient and clear horizon.

In his second part, M. Stoppani describes the *Avicula-contorta* beds in Lombardy, previously studied by MM. Collegno, Escher, and Omboni. These beds are there represented by the deposit of the

Azzardla, formed of limestone and marl combined with the black schists and lumachello, which are inferior to them. Both contain *Avicula contorta* and a special fauna, which has already been partly described by the author in his 'Paléontologie Lombarde,' from which this memoir is an extract.

In the third part, the author shows that the palæontological study of the *Avicula-contorta* beds ranges them in the Jurassic series, and that they are of sufficient importance, and so clearly separated from the beds above and below them, to form a distinct stage, to which he gives the name of *étage infraliasien*. The synonyms of these beds in other countries are given by the author as follows:—the Kössen beds in Austria; the Bone-bed and the White Lias in England; the precursor of the Lias or Cloac of Würtemberg; the Sandstones of Helmsingen and Lövelange in Luxembourg; the Sandstones of Hettange; the zone of *Ammonites planorbis* and *A. angulatus* of Oppel; the Limestone of Halberstadt; the Limestone of Valogne; the "*choin bâtard*" of Lyons; the "*foie de veau*" of Burgundy; part of the *Sinemurien* of D'Orbigny; the fourth stage of the Lias of D'Archiac; the Superior Dolomite of Lombardy, &c. The author gives a summary of all the classifications on this subject by means of a table, in which he assumes that the Infra-Liassic stage placed below the zone of *Ammonites Bucklandi* is composed as follows:—1, zone of *A. angulatus*; 2, zone of *A. planorbis*; 3, zone of *Terebratula gregaria*; 4, zone of *Bactryllium* resting on the Keuper.—*Bibl. Univ.* Jan. 20, 1862, *Bull. Sci.* p. 67.

CODIUM BURSA.

In most botanical works this plant is described as being "soft and sponge-like:" this only applies to its dry state. Miss Dyke Poore has kindly sent me two specimens growing together at the base. Instead of the plant being soft and sponge-like, it is hard and firm like a solid fruit, of a very dark olive-green colour; the surface is regularly granulated. The periphery of the globe is entirely formed of dark, transparent, clavate cells, the apices of which form the superficial granules, which are of a hemispherical shape. The appearance of the living plant is very unlike the velvety frond of the *Codium tomentosum*.—J. E. GRAY.

CAPTURE OF DIODON PENNATUM.

The Earl of Enniskillen, having observed a fine specimen of *Diodon pennatum* in the collection of Henry Norris, Esq., F.R.C.S., of Charmouth, and, on inquiry, finding that it was caught a short time ago on the coast near Charmouth, induced Mr. Norris to transmit the specimen to the Collection of British Animals in the British Museum. This is only the second time that the fish has been observed on the coast of Britain.—J. E. GRAY.

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[THIRD SERIES.]

No. 52. APRIL 1862.

XXVIII.—*On a new Fossil Reptile supposed to be furnished with Feathers.* By A. WAGNER*.

“A BIRD is known by its feathers,” says the old proverb. The universal and exclusive applicability of this is recognized not only popularly, but also in zoology: an animal with feathers is a bird. This distinctive character, hitherto regarded as immovably fixed, has all at once been brought in question by one of the most unexpected discoveries. The facts are as follows:—

In the course of the last summer I had the pleasure of receiving a visit from M. Witte of Hanover, who is well known to possess an excellent collection of fossils, and to be well acquainted with them; and on this occasion he informed me that he had seen, in the possession of M. Häberlein, of Pappenheim, a slab from the lithographic stone of Solenhofen, upon which there was a skeleton with such a combination of characters that nothing more surprising and odd could be imagined. This specimen, indeed, wanted the skull and the two hands, but in other respects the most important parts of the skeleton were well preserved. The most remarkable thing about it was that a well-marked coat of feathers was present both on the anterior limbs and on the tail. These feathers agreed in their configuration so exactly with those of true birds, that their interpretation as such could hardly be doubted. The discovery of feathers in the lithographic slate was of itself something unprecedented, but the mode of their union with the skeleton bordered on the incredible. Thus the tail-feathers were attached to a tail possessing not the least resemblance to that of a bird, but presenting a deceptive similarity to that of a *Rhamphorhynchus*. And the attachment of the wings was still more astonishing; for these, on both the

* Translated by W. S. Dallas, F.L.S., from the ‘Sitzungsberichte der Münchner Akad. der Wiss.’ 1861, p. 146.

anterior limbs, formed a fan radiating from the extremity of the fore-arm.

“Obstupui, steteruntque comæ!” The statements made to me by my friend were so unexpected and so much at variance with previous views, that at first I did not know what to think of them. Whether I regarded this mongrel creature as a bird with the tail of a reptile, or as a reptile with bird’s feathers, was no matter; the one was as incomprehensible to me as the other. Nevertheless this singular information came to me from a man whose judgment I could not but respect as that of one well acquainted with the subject. Nothing, therefore, remained for me but to suspend my judgment for the present, and leave it to time to furnish further elucidations of this matter. A long absence, however, prevented my further investigating the affair.

The first contribution towards the completion of my knowledge of this extraordinary animal was furnished by H. von Meyer, in the lately published fifth part of the new ‘*Jahrbuch für Mineralogie*,’ &c. (1861, p. 561), where he reports as follows:—“A fossil from the lithographic slate of the quarries of Solenhofen has been sent to me, showing, with great distinctness, a feather which cannot be distinguished from those of birds. In the organization of the Pterodactyles, which is now so accurately known, there is nothing from which we might infer that those animals were clothed with feathers; this, therefore, would be the earliest trace of a bird belonging to pre-tertiary time. The feather, which is of a blackish appearance, is about 60 mill. in length; and the vane, which gaped somewhat here and there, almost uniformly 11 mill. in breadth. The fibres on one side of the shaft are only about half as long as those on the other. The quill, which was pretty strong, is also indicated. The vane terminates in a somewhat obtuse angle. The feather will represent either a wing- or tail-quill.”

We have thus, from one of the best of our palæontologists, a full confirmation of the correctness of the interpretation given to these parts by M. O. J. Witte; for that this isolated feather belongs to the same type with that seen by the latter is open to no doubt in my eyes, even from the statement of their derivation and the first discovery of such structures in lithographic slate, and it will receive further confirmation immediately, inasmuch as I have obtained from one of my friends, who is perfectly acquainted with his subject and was aware of the statements of the two palæontologists above mentioned, a report upon the same slab which M. O. J. Witte had the opportunity of seeing. Although he had not time to undertake a minute comparative examination of the slab, he was still able at least to acquire an

accurate notion of its principal parts. His report runs as follows :—

“Skull, neck, and both hands wanting. Of the vertebral column, the greater part of the vertebræ of the trunk and the whole of those of the tail are completely preserved. The former are of moderate length, and uncovered; the tail, which measures upwards of 6 inches, consists of about twenty vertebræ of an elongate narrow form, the dimensions of which slowly but constantly diminish, so that the last of them is the smallest. Of the anterior limbs, the humerus and fore-arm are present on both sides; they are strong bones, pretty nearly of equal length, and the fore-arm consists of radius and ulna. At the anterior extremity of each fore-arm there is a broad, short bone, but this is injured.

“Of the pelvis only the right half is preserved; it is but small, and is comparable not with the pelvis of a bird, but rather with that of a *Pterodactyle*. On the left side, the whole hinder extremity is preserved; on the right, only the thigh and shank. The former is a powerful and not very long bone; the latter is somewhat longer and thinner, and is simple; at least, a separation into tibia and fibula is not perceptible. The tarsus consists only of a single powerful bone, which is shorter than the shank-bone with which it is in contact; its lower extremity is considerably widened, and bears three articular processes, to which the three toes are attached. The latter are of moderate length, and armed with strong hooked claws.

“Feathers occur both on the anterior limbs and on the tail; they have, however, left only their impressions, but these show sharply defined outlines, and upon a passing glance they present a deceptive resemblance to birds' feathers. From the above-mentioned short broad bone, which lies close to the extremity of each fore-arm, there issues a radiate fan of feathers, by which therefore, as a structure of this kind radiates from each fore-arm, two feather-wings are produced, having their external outline curved like a bow. The individual feathers are characterized by their fine shafts, on each side of which the delicate striation of the vanes is seen. The largest of these feathers considerably exceed in size that described by Von Meyer.

“Similar feathers are attached to the tail, but with this distinction, that they do not attain the length of the wing-feathers, and, which is of more importance, they do not radiate like the latter from a central point, but spring from both sides of the tail throughout its whole length, and start from it at a small angle. The tail-feathers form a group of an elongated leaf-like or oval shape, of which the narrow end issues from the be-

ginning of the tail, whilst the posterior end is broadly rounded, and extends considerably beyond the last caudal vertebra."

So far this summary report, which thus fully confirms the statements of M. Witte, but at the same time furnishes further important data for the interpretation of this extremely enigmatical fossil, which I shall now attempt. The business now is to ascertain whether this animal, which exhibits at the same time characters belonging to birds and reptiles, is to be referred to the class of birds or that of reptiles. Let us first consider those characters which connect it with birds, and then those which unite it with reptiles.

The most striking resemblance to a bird consists in the clothing of the anterior limbs and the tail with feathers. Feather-formation is only known in birds. Another characteristic similarity to birds is shown by the tarsus, which forms a single bone, but has at its lower extremity three processes for the articulation of the three toes. This structure occurs in all birds, but has not yet been observed in any reptile.

The characters which do not agree with the type of birds are the following:—A divergence of this kind is shown, in the first place, even by the feathers themselves as regards their mode of attachment. The wing-quills of birds are inserted along the whole outside of the hand and fore-arm; in the fossil now under consideration, which unfortunately wants the hand, the fore-arm shows no feathers; and, moreover, the whole wing is attached only to a small bone lying close to the fore-arm, and therefore probably belonging to the wrist, from which it radiates like a fan. Equally strange is the mode of attachment of the feathers on the tail, from which they issue on both sides throughout its whole length uniformly amongst themselves, whilst the rectrices on the short tail of birds are only attached to the last vertebra. As such a mode of attachment of the feathers of the wing and tail is quite foreign to birds, the question finally arises whether these fossil feathers are actually identical structures with true birds' feathers, or only present the external appearance of these. The microscopic examination of their structure and the chemical investigation of their substance might furnish the most certain solution of this doubt.

The structure of the vertebral column is totally different from the type of birds, but, on the other hand, it agrees most closely with that of the long-tailed *Pterodactyles* (*Rhamphorhynchus*). In birds, the sacral and lumbar vertebræ, and the nearest of the dorsal vertebræ, are not only firmly ankylosed together, but also, on the outside, covered by the long lumbar sacrum in the manner of a roof. In the fossil, on the contrary, the sacral and

lumbar vertebræ are free and uncovered, and the lateral bones of the pelvis are but slightly developed. The difference in the structure of the tail is equally striking. All birds, without exception, have a very short and powerful tail, composed of from five to eight, and only in a few cases of nine or ten vertebræ, which bear strong processes, and of which the last is always peculiarly formed, and also, with but few exceptions, the largest. The opposite of all this is exhibited by the tail of the fossil. In this the tail is extraordinarily long, and consists of about twenty vertebræ, which are all elongated, slender, and without processes, and the last of them is the smallest. Such a condition of things is completely in contradiction to the bird-type, but, on the other hand, agrees very closely with that of *Rhamphorhynchus*, in which, moreover, radiating processes issue from the caudal vertebræ, although these are not feather-like, but appear to be simple cartilaginous fibres.

I have thus detailed those data which have become accessible to me, in order to endeavour to answer the question whether this fossil is to be referred to the class of birds or to that of reptiles. The difficulty of doing this with certainty is indeed greatly increased by the circumstance that the skeleton is entirely destitute of certain extremely important parts, of which the skull and the hand may be particularly adduced; nevertheless an attempt at some interpretation must be ventured upon. In the first place, I consider the great uniformity, especially in the structure of the skeleton, presented by the type of birds, which, in comparison with that of the other classes of Vertebrata, only admits of inconsiderable variations; whilst amongst the reptiles—and as in the present case we have to do only with the Saurian order, in these, the most remarkable differences occur within the boundaries of the order, as may be seen from living and still more from extinct species of Sauria. For this reason, therefore, a reptile with the simple tarsal bone of a bird, and with epidermic structures presenting a deceptive resemblance to birds' feathers, is far more comprehensible to me than a bird with the pelvis and vertebral column (especially the long slender series of caudal vertebræ) of a long-tailed Pterodactyle, and with a perfectly different mode of attachment of the feathers. To this we may add that the identity of these epidermic structures with true birds' feathers is by no means proved; they might still only be peculiar adornments. Even amongst insects we find peculiar structures, to a certain extent reminding us of feathers; why, therefore, not also, and in a higher stage of development, among reptiles? If nothing of the kind has yet been found in the latter class, we have already been accustomed in palæontology to meet, in recent discoveries, with previously unknown peculiarities in

the structure of different organs. Consequently, until I shall be convinced by the discovery, in another specimen, of the parts wanting in the one now under consideration, I do not hesitate to regard this as a reptile of the order Sauria; and I give it the name of *Griphosaurus*, derived from γρίφος, an enigma.

This singularly constructed Saurian might also assist us in the solution of another mystery which has not yet been unveiled. It is well known that in certain strata of the Trias we meet with impressions which have been regarded as the *footprints of birds*, although no bones of birds have yet been discovered in any of the Secondary rocks older than the Chalk. As far as these impressions (the signification of which has hitherto always appeared to me very doubtful*) may be actual footprints of animals, we should at least become acquainted in the *Griphosaurus* with a reptile with birds' feet, or, more properly, a reptile with the tarsus of a bird, the footprints of which must therefore have been like those of a bird. By this I do not mean to say that these supposed footprints of birds are due to our new genus, but I only wish to furnish an effective support for the supposition that these footprints are produced not by birds, but by reptiles of an extinct type. In this way also the sequence in the appearance of the Vertebrata, as ascertained from the remains of their skeletons discovered in the rock-beds, would be brought into accordance with the observations of the footprints, in so far as these are truly what they are said to be. The supposed birds' footprints of the Trias would thus by no means be produced by birds, but by reptiles; they would be reptile-tracks.

In conclusion, I must add a few words to ward off Darwinian misinterpretations of our new Saurian. At the first glance of the *Griphosaurus* we might certainly form a notion that we had before us an intermediate creature, engaged in the transition from the Saurian to the bird. Darwin and his adherents will probably employ the new discovery as an exceedingly welcome occurrence for the justification of their strange views upon the transformations of animals. But in this they will be wrong. If I say of the Frog that it was originally a fish, I can at least justify such an assertion; because I can positively show by specimens the transition of the fish into an Amphibian, from the first states of a fish-like tadpole through a whole series of intermediate steps. I cannot indeed require that, in regard to *Griphosaurus*, Darwin should show me such intermediate steps, for of this genus we only know a single and imperfect specimen; but I am entitled to ask of the Darwinians, if they should desire to cite the *Griphosaurus* as an intermediate creature undergoing

* See my 'Geschichte der Urwelt,' ii. p. 423.

a transformation from a reptile into a bird, to show me, first of all, the intermediate steps by which the transition of some one living or extinct animal from one class into another was effected. If they cannot do this (as they certainly cannot), their views must be at once rejected as fantastic dreams, with which the exact investigation of nature has nothing to do.

XXIX.—*On the Remains of Fish and Plants from the Upper Limestone of the Permian Series of Durham.* By JAMES W. KIRKBY.

THE fossils provisionally noticed in this communication have been found in the Upper Limestone of the Permian series of Durham. The most important of them are the remains of Fish, most of which appear to be undescribed. The others, which are the least numerous, belong to vegetables.

Previous to the discovery of these fossils the remains of fishes were not positively known to occur so high in the Permian series of the district named, the Marl-slate being the chief and almost only subdivision in which they had been found. The Marl-slate is nearly at the bottom of the series; the Upper Limestone is almost at the top, it being the uppermost member, with the exception of the Bunter Schiefer, which is unrepresented in the immediate region where these fossils occur. Hence they are amongst the latest—if not themselves the latest—traces that we possess of palæozoic Vertebrata.

The locality where the fossils are found is in a quarry belonging to Sir Hedworth Williamson, Bart., at Fulwell Hill, near Sunderland. The bed in which most of them occur is not more than 2 feet thick. It is mostly laminated and very fissile, and it varies from a soft, earthy, yellow limestone to one that is hard, crystalline, and grey.

Nearly all the fish are small *Palæonisci*, the largest of which is only 4 inches in length, most of them being less. Fragments of a larger fish, apparently belonging to the genus *Acrolepis*, have also occurred, as well as impressions of others, intermediate in size, which are so obscurely preserved as to prevent any decision as to their affinities.

1. *Palæoniscus varians*, n. sp.

Maximum length 4 inches; greatest depth 1 inch or a little more. Head somewhat less than one-fourth of the entire length, and a little longer than wide; orbit large, and placed well forward; mouth of medium size; operculum large, and covered with delicate rugose ornamentation. Pectoral fins small; ven-

trials small, placed a little in advance of posterior half of body; anal fin larger than the preceding, situate at the commencement of last third of body; dorsal somewhat larger than the anal, and placed between the ventrals and anal, but nearest to the latter; caudal fin of moderate size, heterocerque, though not greatly so, spreading slightly outwards, with both lobes of nearly equal length. Scales vary greatly in size, those of the flank in the abdominal region being much larger than those covering the dorsal, ventral, and caudal portions of the body, except in those parts where large scales advance for some distance in front of the dorsal, anal, and caudal fins; the scales traversed by the lateral line and those adjoining are more or less subrectangular, the former being characterized by a deep notch in the upper half of the posterior margin; the scales of the caudal region are more rhomboidal in shape: the exposed margins of all the scales are plain; two or three lines of growth generally mark the surface just within the exposed margins; and the surface, though smooth to the naked eye, is finely shagreened when magnified.

2. *Palæoniscus Abbsii*, n. sp.

Length $4\frac{2}{10}$ inches; greatest depth $\frac{6}{10}$ inch, or little more than one-seventh of entire length. Length of head 1 inch; breadth rather over half an inch. Form of head elongate, with a somewhat projecting snout; branchiostegal rays four or five? Dorsal fin a little in advance of anal, but the posterior rays of the one are parallel with the anterior rays of the other; caudal fin more decidedly heterocerque than in the preceding species. Scales smooth, except in being marked marginally by lines of growth as in the preceding species; their shape resembles that of the scales of *Palæoniscus varians*, except in those on the flank being of less relative width; those of the lateral line are notched.

3. *Palæoniscus latus*, n. sp.

Length $2\frac{1}{2}$ inches; breadth $1\frac{1}{10}$ inch, or somewhat less than one-half the entire length. Head: length $\frac{7}{10}$ inch; depth a little less; slopes rapidly downward from the occipital region to the snout; snout very obtuse; gape small. Fins small; ventrals placed at the deepest part of the body, less than half an inch from the head; the other fins are placed similarly to those of the preceding species. The scales on the flank are longer than in *P. varians*, and arranged in much steeper rows; their general form, however, shows no essential points of difference from the scales of that species.

The general form of this fish is gibbose; and in this respect it differs strikingly from the species already noticed, more especially from *P. Abbsii*.

4. *Palæoniscus* — ? n. sp.

A single example of what appears to be another species of *Palæoniscus* has occurred along with those described. It is about 3 inches long, a little more than half an inch in depth, and its head is $\frac{7}{10}$ inch in length. It differs from the species noticed in having a more pointed head and a produced snout, also in the greater length of its dorsal, anal, and caudal fins. As it seems, however, to possess some points of resemblance to *Palæoniscus angustus*, Ag., of the Zechstein, I refrain from describing it as new until I have compared it carefully with that species.

Acrolepis Sedgwickii, Ag.

Associated with the *Palæonisci* there has occurred a single fragment of *Acrolepis*, apparently belonging to the species *A. Sedgwickii* of the Marl-slate. This specimen is 7 inches long, and is minus head and part of tail, so that it has probably belonged to an individual that was little under 12 inches in length. Other fragments of this species have also been met with in the limestone above the bed containing the *Palæonisci*, but in a more imperfect state of preservation than the first.

Besides these remains of fish, there have also been found in the two-feet bed first mentioned, and in the adjoining overlying and underlying strata, a few remains of plants. They are, unfortunately, very imperfectly preserved, and hence very difficult to determine. They are evidently, however, the remains of terrestrial vegetation; at least, they possess character enough to show that they do not belong to the Algæ.

XXX.—*Observations on the Geographical Distribution of Fungi.*

By M. E. P. FRIES*.

THE Algæ and the Fungi properly so called are distinguished from other cellular plants by their larger size, their brighter colours, and by the greater variety of forms met with among them. These two orders of cellular plants have attracted the attention of observers from an early period, and were indeed the only Cryptogamia which at a remote period were applied to use; for it is only within a comparatively recent date that the Lichens have acquired a corresponding interest: on the other

* Translated by Dr. J. T. Arlidge, from the 'Annales des Sciences Naturelles,' 1861, 4 série, tome xv. (Botanique), p. 10. The original memoir appeared in the 'Transactions of the Academy of Upsala' for 1857, only a year before the premature death of the author; the French translation is by Dr. W. Nylander.

hand, the Mosses, Hepaticæ, and lower forms of Algæ have not hitherto been available for any useful purpose, and the Mucedines are chiefly known by the injurious effects they produce to other plants. These considerations afford an explanation of the circumstance that the Greeks and Romans distinguished so long ago a considerable number of species of Algæ and Fungi, principally of such as were either useful or noxious, whilst they completely neglected the other tribes of Cryptogamic plants, as is illustrated by the fact that they comprehended under the collective name of Muscus the whole class of Mosses.

Upon the revival of botanical science in the sixteenth century, the Fungi attracted the attention of naturalists beyond all other cellular plants. In the course of this century, in 1583, Cæsalpinus published his famous work '*De Plantis*,' in which the Fungi were not forgotten. But the first work of a special character devoted to this class of plants was that of Charles de l'Ecluse, published in 1601, entitled '*Fungorum in Pannoniis observatorum brevis historia*,' and at a later date the '*Theatrum Fungorum*' of Sterbeeck. These two works treated especially of the higher Fungi. Subsequently a multitude of treatises on the Fungi in general were produced, among which several survive to our time and still possess great value—such, for instance, as those of Vaillant, Micheli, Battara, and Schæffer. It was not until the eighteenth century that the oceanic flora received at the hands of naturalists the attention it merited, although in our own day it has become so favourite a study that few departments of botany can boast of so large a number of distinguished cultivators.

At the present time the superior Fungi are, it must be admitted, very indifferently studied; and consequently their geographical distribution is more imperfectly known than that of the other classes of the vegetable kingdom. The majority of those who make the Fungi a special study are almost exclusively interested in the Mucedines, in the lower forms of the class, and in the parasitic and epiphyllous species. One reason for this predilection for those tribes of Fungi is doubtless to be found in the circumstance that they may be more readily preserved in herbaria, and that in consequence it becomes more easy, by the aid of such collections, to determine species already known. A similar advantage, on the other hand, is unattainable in the case of the higher Fungi; for their fugacious nature, and the difficulty encountered in attempting to preserve their colour and natural form, compel naturalists on every occasion to procure fresh specimens and study them anew, at the sacrifice of much time and labour bestowed in the task of making themselves acquainted with what has been already made out. The same cause renders

it incumbent on the observer to carry on his researches on the living plants where they happen to grow. Such, I believe, are the principal circumstances which deter mycologists of the present day from the study of the higher Fungi; for, so far as regards the determination of specific forms, it may without fear of contradiction be maintained that it is more easy in their case than in that of other Cryptogamia.

The most certain means of obviating the difficulties pointed out is to make a collection of faithfully drawn and coloured figures, which may compensate for the absence of actual specimens; and, in fact, no division of the Cryptogamia is so thoroughly illustrated in books as that of the higher Fungi. It is a point of the greatest interest to science that the original drawings of the figures contained in the works of L'Ecluse and Sterbeeck should be most carefully preserved, and it is most gratifying to learn from M. Kickx that this is done. These drawings are to be seen in the library of Brussels. The published figures are not coloured, and owing to this it often becomes impossible to identify specimens with certainty. The same defect obtains in the plates of the treatises of Micheli, Buxbaum, and Battara, and of other writers prior to Schæffer. The work of the last-named author, entitled '*Icones Fungorum qui in Bavaria et Palatinata circa Ratisbonam nascuntur*' (1762-1774), must be still esteemed of eminent value in all that relates to the higher Fungi. Among other illustrated works of importance are those of Batsch, Bolton, Bulliard, Sowerby, &c.; and a considerable number of useful figures is contained in some works of a more general character, such as the '*Flora Danica*,' the '*Flora Austriaca*' of Jacquin, and in many others of less note.

With respect to synonyms, it must be confessed that the authors just cited, and Persoon himself, have not taken time to study carefully the labours of their predecessors, but have more frequently described as new every form they have met with, except some of the most common and well-known species. The synonymy of this class has therefore been largely added to; and it is only in the '*Systema Mycologicum*' and in the '*Epicrisis Systematis Mycologici*' (works by my father) that a complete history of the older literature of the subject is to be met with.

The following observations given by Fries in a foot-note appear to us to deserve a place here, inasmuch as they explain the grand outline of his principles of classification, and furnish a key to the right understanding of the divisions and groups of Fungi hereafter spoken of:—

“The most diverse forms are brought together under the general appellation of Fungi. Adopting the mode of fructification

as the basis for their systematic distribution, we find considerable and essential differences in the manner in which that process is effected present themselves, suggesting a useful division of the Fungi into three subclasses, as follow :—

“1. Fungi properly so called, adopting this appellation in its oldest sense and according to prevailing usage. They are recognized by their *hymenium* (proligerous lamina) bearing free spores, commonly attached in groups of four at the summit of the sporophores. The most highly developed types and the most important Fungi appertain to this subclass, and are further notable in presenting no near affinity either with Lichens or with Algæ.

“2. Semi-Fungi (Mycetes), which also possess a distinct proligerous lamina, but have their spores habitually enclosed, in groups of eight, within enclosed sacs or *asci*. This subclass is constituted of the Discomycetes and Pyrenomycetes, which exhibit a transition towards the Lichens, with the fructification of which they present the closest resemblance.

“3. Moulds (Mucedines), or Fungi destitute of a proligerous lamina, and which are allied by insensible transitions either to the Byssaceæ or, more particularly, to the lower Algæ, from which, in many cases, they are undistinguishable except by habitat and other biological characters.”

Before entering on the account of the distribution of the Fungi, especially of their higher forms, throughout the different regions of the globe, we will point out, in a few words, what are the countries respecting which we have information on this subject, and what is the value of that knowledge. In Europe, Scandinavia and England are the countries most thoroughly and exactly known; and next to them certain portions of France, of Germany, of Italy, of Switzerland, and the environs of St. Petersburg may be mentioned. As to America, many remarkable Fungi have for a long time been known to flourish there. Bosc was the first to furnish some special though imperfect notices of American Fungi; but Schweinitz may be looked upon as having been the true founder of American mycology, by the publication of his work on the Fungi of Carolina and of the United States generally. Several distinguished naturalists occupied in the special study of mycology are to be found in America, among whom Messrs. Curtis, Ravenel, and Lecomte may be named. Some considerable collections have, moreover, been transmitted to Europe by different travellers from the United States and Mexico, and have been described by Berkeley, Montagne, and Fries. Central and Southern America have equally furnished rich collections, which have reached Europe and been described by the same writers. The other portions of the world

are comparatively less known. Asia is little known, except it be the islands of the Indian Archipelago, the Philippine Islands, and the Himalaya Mountains. The most important works on the mycology of these distant regions are those of Junghuhn, relative to the Fungi of Java, and those of Berkeley, which have made us acquainted with the rich collection brought from the Himalayas by Dr. Hooker. With respect to Africa, Algeria has been pretty well explored; Egypt and Guinea have been only partially so; but the Cape of Good Hope and Natal have been examined by several collectors, among whom must be mentioned with especial praise my fellow-countryman, Wahlberg, to whom I am indebted for a rich collection of specimens: nevertheless the mycology of the South Sea Islands (Oceania) is still better known, inasmuch as successful explorations have been carried out by all the scientific expeditions which have visited those parts.

We have deemed it necessary to trace the foregoing sketch of the sources of information to which we owe our acquaintance with the geographical distribution of the Fungi; we will now attempt a brief exposition of this distribution, confining our remarks more particularly to the higher forms (Hymenomycetes and Gasteromycetes), since our knowledge of the inferior or simpler Fungi (Gymnomycetes and Haplomycetes) is as yet too incomplete, and our notions of the characters to which a generic importance should be assigned too vague to allow of the indication of the same general results with regard to them.

I.

With reference to the Gymnomycetes and the Haplomycetes of non-European countries, the United States of North America excepted, little or nothing is known, except it be respecting some parasitic epiphyllous forms. These do not present genera peculiar to the different zones of the globe; yet it must be admitted that the number of their species or forms augments in an equal proportion with that of the plants which inhabit them. In fact, these Fungi are clearly subjected to the same law as prevails with other low organisms, the species of which are spread in a more uniform manner over the globe than those of more highly organized beings. Inasmuch, too, as these inferior organisms are dependent rather upon their matrix and on local conditions than on the influence of climate, we have an explanation why their distinctive differences are of less essential importance. Thus it is a well-known fact that the most common of the mildews, the *Penicillium crustaceum*, is to be met with alike on the Alps of Lapland and in the oasis of Jupiter Ammon in the Libyan desert,—an example which has no parallel in the geographical distribution of the higher plants.

One of the most remarkable circumstances in the history of the lower Fungi is that of their sudden appearance in immense numbers, and their rapid extension, whence, particularly of late years, some disastrous and destructive epidemics, both among animals and plants, have resulted,—as, for example, the ravages produced by the *Oidium Tuckeri*, the cause or the manifestation of the vine-disease; or the plague-like epidemic of the silk-worm, from the attacks of the *Stachylidium Bassianum*; or the destruction of the common Flies, usually resulting from the parasitic growth of the *Sporendonema Muscæ*. The potato-disease is also accompanied by the growth of several Mucedines; but their presence nevertheless is evidently nothing more than the consequence, and not the efficient cause, of the morbid affection. As another example, it is well to mention the *Lanosa nivalis*, which grows in spring in the melting snow, and is suspected to be the cause, in many instances, of the death of the germs of the sprouting rye.

The semi-Fungi (Discomycetes and Pyrenomycetes) exhibit genera characterized sometimes by a hard and carbonaceous, and at other times by a soft and somewhat waxy texture. The latter consistence predominates among the Discomycetes, and the woody texture among the Pyrenomycetes. The last-named, again, are slow in growth; whereas the Discomycetes increase rapidly, and, moreover, resemble in their mode of development, in many respects, the Hymenomycetes.

The Pyrenomycetes, particularly those that attain the greatest development, have a more extended geographical range than any other of the Fungi. They are to be met with everywhere, except in water [one species, however, the *Sphæria Posidonie*, always vegetates under water], and especially where vegetation of any sort is in process of decay. In fact, they possess a high importance in the general economy of nature, because they accelerate the decomposition of dead and dying organisms. The richer the vegetation of a country is, the more numerous and varied are the forms of Pyrenomycetes to be found there.

The more highly developed Pyrenomycetes evidently have their geographical centre in the torrid and temperate zones; their dimensions and astonishing variety of form increase to the south of the equator, as is instanced in the genera *Xylaria*, *Dothidea*, *Diatrype*, &c.; in the same way *Sphæria* and *Hypoxylon*, between the tropics, vegetate under an infinite variety of forms, for the analogues of which it is vain to seek in the forests of Europe. The superior Discomycetes, on the contrary, such as the Helvellaceæ (*Morchella*, *Gyromitra*, *Helvella*, *Geoglossum*, &c.) and the Bulgariaceæ (*Leotia*, *Bulgaria*), grow by preference in the colder portions of the temperate zone. This circum-

stance is indicated by the fact that their most remarkable species make their appearance ordinarily in early spring, as is observed in the case of *Helvella*, *Morchella*, *Verpa*, *Discina*, and in many of the largest and most beautiful *Pezizæ*, which, like the *Peziza tuberosa*, *P. acetabulum*, *P. melæna*, *P. coccinea*, *P. majalis*, *P. protracta*, &c., show themselves frequently during the melting of the snow.

Notwithstanding these differences, all the principal groups of semi-Fungi, and their large genera, are common to every country on the globe. Some genera, less rich in species, though remarkable in many points, belong exclusively to particular countries: thus, among the Pyrenomycetes, the genus *Cyttaria* is found to be limited to the region of the Antarctic beech-trees; and among the Discomycetes, the genus *Spadonia* has been observed only in Brazil. Many, however, generally reputed to be peculiar to certain countries, have at a later period, by means of more attentive researches, been discovered elsewhere,—as, for example, the genus *Urnula*, which was at one time considered peculiar to North America, is found to be represented by the *Urnula minor* in Guinea. In the same way another genus of North America has been discovered by M. Lindblad in Sudermania.

Among the Pyrenomycetes there are not a few very remarkable genera peculiar to tropical countries; such are *Thamnomycetes*, *Camillea*, *Kretschmaria*, *Leveillea*, &c., and probably many others yet unobserved amid the rich vegetation of those regions. An attempt to point out what genera of Pyrenomycetes are there absent would be too daring a proceeding in the present imperfect state of our acquaintance with respect to the Micromycetes of those countries; for these productions of the vegetable world are rarely gathered by travellers, to whom it is that we are indebted for the materials for our study. What strikes the attention of the observer is the circumstance that several large genera of Fungi evidently correspond to each other, one in the torrid, another in the temperate zone; for example, in the temperate zone, the *Erysiphæ* are evidently the analogues of the *Meliolæ*, which inhabit the torrid zone.

The Tuberaceæ, properly so called, must be placed with the Mycetes (semi-Fungi), by reason of their spores being enclosed within thecæ. Although at first sight they resemble rather the Gasteromycetes, and, by their mode of evolution, the Hymenogastres, still their fructification is so different that they must be referred to the division before named. There are also intermediate forms between the Tuberaceæ and the other semi-Fungi—as, for instance, certain hypogeous *Pezizæ*, such as the *Peziza sepulta*, which makes its appearance yearly, after the copious rain of autumn, in the sanded avenues of the Botanical

Garden of Upsala. The poverty of Sweden in representatives of the Tuberaceæ is a remarkable peculiarity of the country—one genus only, and in fact only one single, recently discovered species of that genus, viz. the *Tuber niveum* (*Terfezia Leonis*, Tulasne), being found in two places in Ostrogothia; and even there it appears to be rare. On the contrary, in Central and Southern Europe these Fungi are common; and even in the south of England their species are tolerably numerous. The reason for the presence of a greater variety of species of this group of Fungi in England is to be found in the circumstance that the Tuberaceæ are developed chiefly during the winter, and because England, by reason of its insular position, enjoys milder winters and has a greater rainfall, and thereby furnishes more favourable conditions for the vegetation of these Fungi. In Sweden, on the contrary, the severe cold of winter and the frozen soil preclude the growth of Tuberaceæ. These Fungi, in conclusion, have their centre in the warmer regions of the temperate zone; for in hot climates their evolution is often interrupted or destroyed by the excessive heat.

II.

Heat and humidity are the two conditions generally recognized as most concerned in the vegetation of a country. No order of plants is more dependent on these conditions than the Fungi,—a fact peculiarly true in reference to the higher forms, or true Fungi, Hymenomycetes and Gasteromycetes, many of which do not make their appearance unless the weather is peculiarly favourable, or, in other words, after very abundant rains. Plants of this sort, which only show themselves under extraordinary atmospheric conditions, are called “*meteoric*.”

The fact must not be lost sight of in this place, that some species of Fungi which have formerly been common in certain localities may become within our lifetime more and more scarce, and even altogether cease to grow there. The cause of this, doubtless, is the occurrence of some change in the physical constitution of a locality, such as that resulting from the destruction of a forest, or from the drainage by ditches and cuttings of more or less extensive swamps, or from the cultivation of the soil,—all of them circumstances which cause the destruction of the primitive fungaceous vegetation, and the production of a new one. If we compare the fungaceous flora of America with that of European countries, we observe that the former equals in its richness and the variety of its forms that of the Phanerogamous flora; it is probable, however, that, in the lapse of more or fewer years, this richness will decrease in consequence of the extension of cultivation—as is illustrated, indeed, in what has

already taken place in the more thickly peopled districts, as, for example, in the vicinity of New York

There is this difference between the Fungi and other vegetable productions—that the former seem to be especially dependent on the existence of humidity, whilst heat is the more essential condition to the development of plants of a higher organization. Thus it is that the richness of vegetation in general and its whole aspect differ so remarkably, according as the country in question varies in regard to temperature, whereas the amount of atmospheric moisture and rain predominates as the cause which most materially determines the differences in the vegetation of Fungi. Meteoric forms are likewise met with among the higher Fungi, which become developed principally in hot years, and in localities which are, as a rule, under water, but have become dried up by the heat. A parallel to this is to be found among those Phanerogamia which in nature make the nearest approach to Fungi, as, for example, *Orobanche* and *Monotropa*, which flourish in the greatest abundance when the temperature ranges high and repeated rains sodden the soil.

Further, the circumstance that the higher forms of Fungi more especially flourish during the colder weather at the close of autumn, such as, for instance, *Agaricus velutipes*, *A. serotinus*, *A. melleus*, &c., proves that heat is not an indispensable condition to the growth of these plants. Still it cannot be denied that the fungaceous vegetation is usually more luxuriant if there is an abundant fall of rain in August; and it is under such circumstances that the *Amanitæ* and *Boleti* make their appearance in the greatest number. From the fact of North America, where rain falls very copiously, being one of the countries most fruitful in Fungi that is known, the deduction may be fairly drawn, that moisture is a physical condition peculiarly favourable to the development of those plants.

The globe is divisible into several zones, according to the degree of heat, and its more or less unequal distribution throughout the course of the year: but, so far as the geographical distribution of the Fungi is concerned, these divisions have very little practical or useful application; for the differences discoverable between the fungaceous vegetation of particular regions are not so strongly marked as in other cases, and it often happens that countries widely separated possess the closest affinities in reference to their indigenous Fungi. It is enough to admit of the existence of two zones, peculiar in their fungaceous growths—namely, a temperate and a tropical zone; for the frigid zone of geographers produces no peculiar types different from those of the temperate zone; it is merely poorer in species. As to the tropical and subtropical zones, no essential distinction can be

pointed out in the present state of our information respecting their fungous inhabitants. However, these statements are not to be interpreted to signify the existence of any well-defined limits; for either one of the zones described passes insensibly into the other in countries intermediate in position, as is especially illustrated in North America, where the tropical forms of Fungi extend themselves far northward.

The characteristic differences of the two zones are obscure in the case of the lower orders of Fungi, but much more striking in the higher forms. They are particularly evident in the Gasteromycetes, several genera of which are the denizens specially of tropical lands, and among the Hymenomycetes, which in these same regions assume a tough and woody consistence, whereas in the cold and temperate zones of the globe they become more fleshy, and are decomposable with greater rapidity. It has for a long time been the belief that the fungaceous vegetation of the tropics was poor, because it was imagined that the heat would arrest its development; but more attentive observation proves the fallacy of this opinion. It is only in the most arid regions of the earth that a distinct fungaceous flora appears to be wanting. In the primitive forests of tropical countries the presence of Fungi is not connected, as it is in these temperate regions, with a particular season; it is constantly the same throughout the year.

Whilst the species of Fungi in the temperate zone are distributed in a very uniform manner, they appear to follow, on the contrary, in tropical regions, a more special plan of diffusion in the several countries. However, there are Fungi that may be called cosmopolitan, such as *Agaricus* (*Amanita*) *muscarius*, *A.* (*Psalliota*) *campestris*, *A.* (*Naucoria*) *pediades*, *Schizophyllum commune*, *Polyporus versicolor* and *P. igniarius*, *Lycoperdon gemmatum* and *Lycogala epidendron*, &c.

Great differences have been noticed, in reference to their fungaceous vegetation, between Cuba, Java, and the Philippine Islands; yet in all these countries the preponderance of the *Polypori* is a fundamental or characteristic feature. That the fungaceous floras of very distant countries may be very similar is distinctly shown in the instance of North America, which possesses the majority of European species, besides those others peculiar to itself. The island of Juan Fernandez, which has been very carefully explored, presents a fungaceous vegetation differing in only one-third of its forms from that of Europe. The same holds true, it is asserted, with respect to the Fungi of New Zealand and of Australia, although these countries do also possess indigenous genera unknown in Europe.

Since the Fungi are less dependent on heat than on the

moisture of the climate and on the nature of their matrix, the two mycological zones already distinguished are divisible into several regions according to their greater or less amount of humidity, and not according to their latitude or their elevation above the sea; for these are circumstances that seem to exercise little or no influence upon the Fungi. In this fact we get an explanation why the fungaceous floras of Southern and of Northern Europe respectively differ essentially so little that no distinction can be justly instituted between them; indeed, with reference to this point, it would perhaps be easier to separate Eastern from Western Europe.

In any region whatever, it is necessary in the first instance to draw a distinction between its open naked plains and its wooded tracts. In the level open country there is a more rapid evaporation of the moisture by the conjoined action of the sun and wind; whence it happens that such a region is more bare of Fungi than one that is mountainous or covered by woods. On the other hand, plains possess several species peculiar to themselves, as, for example, *Agaricus* (*Naucoria*) *pediades*, certain *Tricholomata*, and, above all, the family Coprini, of which they may be regarded as the special habitat. The species of this family augment in number, in any given country, in proportion to the extent and degree of its cultivation; for instance, they grow more luxuriantly in the province of Scania, in Sweden—a district further distinguished above all others by its cultivation and fertility. In well-wooded countries, moisture is retained a much longer time, and, as a result, the production of Fungi is incomparably greater: and it is here desirable to make a distinction between the Fungi growing in forests of resinous-wooded trees (*Coniferæ*) and those which inhabit woods of other trees; for these two descriptions of forests may be rightly regarded, as to their fungaceous growths, as two different regions. Beneath the shade of *Coniferæ*, Fungi are earlier in their appearance, so much so that it often happens they have attained their complete development when their congeners in forests of non-resinous trees have scarcely commenced their growth. In woods of the latter sort, the fallen leaves, collected in thick layers, act as an obstacle to the soaking of moisture into the earth, and thereby retard the vegetation of Fungi; on the other hand, such woods retain moisture longer. These conditions afford to several large and remarkable species the necessary time for development. I will cite, for example, *Polyporus frondosus*, *P. umbellatus* and *P. giganteus*, *Hydnum erinaceus*, *H. coralloides*, *H. septentrionale*, &c. The beech is characteristic of our own region; but further north this tree gives place to the birch. Coniferous woods are, moreover, divisible into two regions—that of the Pines and that of the Firs.

The latter is richer in species than the former, because, as is well known, fir-trees flourish in more fertile and moister soils. Whether, with respect to the south of Europe, other subdivisions into regions are required, we know not; still less are we able to decide on the like question in reference to the countries beyond Europe.

We will now point out in a few words the great differences which prevail between alpine regions of the temperate zone and those of the tropical zone in relation to the distribution of Fungi. In Lapland, according to Wahlenberg ('*Flora Laponica*') and other travellers, the higher forms of Fungi are excessively scarce. Here and there, and only in the forests, some of the lower Fungi or rare Agarici are scattered. The cause of this circumstance is readily understood when we reflect that the summer is hot and of very brief duration, and that the autumn is exceedingly short, and, moreover, accompanied almost daily with severe frosts. In the districts of Nordlanden and of Finmark, which border on the sea, and enjoy by that position a milder climate, the Fungi are more plentiful, "*ob rorem marinum ibi frequentissimum*," as Wahlenberg remarks. In the marshes and on the borders of the lakes of Lapland several Fungi grow, such as *Mitrula paludosa*, *Spathulea flavida*, *Cantharellus lobatus*, &c.; but, from all that we know, the Alpine region of Lapland is the poorest of all in species of Fungi. Wahlenberg remarks that, in the case of the subalpine forests of the Carpathians, the number of Fungi is rather considerable, which shows that in the latitude of this chain of mountains they are more abundant than amid the frosts of Lapland. But if we turn towards the alpine regions of tropical countries, we encounter an entirely opposite state of things; for it is among them that the fungaceous vegetation is most rich in forms and most luxuriant, in situations where the elevation above the sea-level secures a temperate climate. Thus, Junghuhn ('*Præmissa in Floram cryptogamicam Javæ insulæ*'), during his stay in Java, discovered that Fungi grew especially at an altitude of from three to five thousand feet above the sea, and that their abundance decreased above as well as below that zone; moreover the vegetation of the Fungi proceeded unimpeded during the whole year, notwithstanding the variation of the seasons. The same thing has been observed in other tropical countries, as, for instance, in Central America and in the East Indies. In the alpine regions of Upper Asia, Dr. Hooker (see Berkeley, '*Decades of Fungi*,' Dec. xxxii., xxxiii.) has remarked that Fungi were most abundant at an elevation of seven or eight thousand feet above the sea, and were at the same time very scarce in the plains.

The *stations* of species are determined by the physical conditions presented by different localities. In relation to this subject, a distinction must be made between Fungi which grow from the soil (*Fungi geogenei*) and those which grow on dead plants (*Fungi epiphyti*). The most highly developed and perfect species of each series all grow on the ground, as *Amanita*, *Boletus*, &c. ; they are epigeous, though the mycelium of most of them vegetates beneath the soil upon decayed wood or the worn-out bark of trees. The species lowest in the scale of organization are, on the contrary, epiphytes. Among those Fungi whose existence is most independent of the influence of light, there are several species, and even entire orders, such as the *Tuberi*, which are '*hypogeous*,' or, in other words, which live entirely beneath the surface of the ground. The most evident proof attainable as to how far the development of Hymenomycetes requires the action of light is, that such as have not been exposed to its influence (those, for example, which have lived in the galleries of mines, in caverns, or in hollow trees) assume strangely anomalous forms. The metamorphosis of such individuals remains incomplete, or, in other words, every Fungus preserves its mycelium-nature, its abnormal growth being limited to a monstrous modification of this mycelium.

The '*coprogenous*' Fungi (those growing on manure and those which flourish on decayed wood) occupy an intermediate position between geogenous and epiphytic Fungi. These coprogenous forms acquire their complete proportions in a very brief period, and are decomposed with similar rapidity, in consequence, without doubt, of the great quantity of nitrogen they imbibe in their ordinary matrix. On the contrary, the Fungi which live upon trees grow very slowly, on account of the hardness of the *substratum* ; many species of them, which live at the expense of the hard wood or of the bark, are perennial, and annually form new layers overlying those of older date. These perennial species abound in tropical climates, and decrease in number gradually as we approach the poles. It might, *à priori*, be supposed that these Fungi would, on account of their solid texture, suffer less from the effects of cold, and that, for this reason, they would advance further north in their distribution : such, however, is not the case ; for it is those Fungi which most speedily attain their full and complete development which are found to exist at the greatest altitudes on the Alps ; and this so happens because their development may be frequently accomplished within the space of twenty-four hours.

The influence of the chemical constitution of the soil on the production of Fungi is not at present understood ; but it is perfectly well known how materially the richness of the soil in

“humus” contributes to the beauty and abundance of fungaceous vegetation. An essential difference among the various Fungi must, however, be noticed; for whilst certain of them, such as *Cortinarius* and *Hydnum*, avoid all cultivated ground, for the reason that it is too much impregnated with animal matters, others, on the contrary, as *Pratellus*, *Panæolus*, and, above all, the *Coprini*, are never found to flourish elsewhere. Sandy plains are always very poor in Fungi; but the rare species which do grow in such localities are peculiar to them: as instances of this may be cited *Agaricus* (*Inocybe*) *maritimus* and *Peziza arenaria*. No Fungi grow in water; still, in connexion with species of *Sphagnum*, in marshes, several species are met with, the pilei of which alone show themselves above these submerged mosses.

The epiphytous Fungi are not parasites properly so called (as many Fungi belonging to the lowest families or the lowest ranks in the class are); for they never grow except on those parts of plants that are in a state of decay or of decomposition. For though it often happens that Fungi are seen growing on trees still living, yet, if a closer examination be made, it will always be found that they have their nidus in an altered or decayed portion of the wood, even when the superposed bark itself appears to be sound.

Certain Fungi are peculiar to certain trees, and are found on no others—a circumstance which particularly arrests the attention when the Fungi proper to coniferous trees are compared with those that live on trees with large and deciduous leaves. But, further, among the latter forms of Fungi there are species which exclusively belong to certain species of trees. The following are examples of some such:—*Agaricus* (*Pleurotus*) *utnarius* and *A. ostreatus*, together with *Polyporus squamosus*, grow upon most of our deciduous-leaved trees; *Agaricus* (*Armillaria*) *mucidos* finds a fitting habitat only on the beech-tree, *Fistula hepatica* only on the oak, and *Polyporus salignus* and *Trametes suaveolens* only on willows; *Agaricus* (*Omphalea*) *campanella* and *Hydnum auriscalpium* grow on the leaves and cones of pines, *Trametes pini* on the trunk of the same trees; whilst *Polyporus abietinus* and *Trametes odorata* grow only on the fir. The Hymenomycetes which lead a parasitic existence upon other Hymenomycetes—for instance, *Agaricus* (*Mycena*) *pilipes*, *Ag.* (*Collybia*) *tuberosus*, *Boletus parasiticus*, *Nyctalis parasitica*—are all meteoric, and are among the most singular of the Fungi.

It would be superfluous to follow out these general observations on the stations of Fungi in detail, and we will content ourselves by referring the reader to the work of M. Nicolas

Lund, entitled 'Conspectus Hymenomycetum circa Holmiam crescentium.'

In botanical geography, great importance is attached to the differences prevailing among plants in relation to their distribution, according as they are diffused, isolated, or numerous in the localities they inhabit. These differences are, in the case of the Fungi, even more manifest than among the Phanerogamia: there are species of Fungi of which isolated individuals only are to be found; others always met with in groups of larger or smaller numbers; and others, again, which constantly grow in dense clusters or aggregations. Among those species of the second variety named which are collected in social groupings, the aggregation is frequently the result of all the individuals springing from a common mycelium. Sometimes such collections form in extended circles or in long lines, according to the mode of development of the mycelium, which at times expands itself in a centrifugal manner, or circularly, and develops the Fungi at its periphery, and at others elongates itself only in one direction. The *Merulius lacrymans* (the common Fungus of the house) grows in a circular fashion, and attracts moisture from the atmosphere, which it afterwards exudes from its periphery in the form of aqueous drops: by this property it hastens the progress of decay of the wood, which is a necessary condition to its development. In hot countries a no less curious form of mycelium is observable, consisting of a filamentous mucilage, to which particles of earth, small stones, and other fragments of matters it encounters in its expansion become so agglutinated as to constitute a sort of conglomerate, which, on being dried, assumes a hardness equal to that of stone itself. In this manner the *pietra fungaja* of Italy is formed by the mycelium of *Polyporus tuberaster*; in tropical countries, some similar productions are due to the mycelium of certain species of *Lentinus*.

The stations of Gasteromycetes are generally the same as those of Hymenomycetes. The Phallodei and the Hymenogastrei, which are the most important groups of Gasteromycetes, all grow upon the ground—are geogenous. The Nidulariacei and the Lycoperdacei are partly geogenous and in part epiphytes. Among the Trichodermacei are the two singular genera *Asterophora* and *Onygena*, the former of which is parasitic on other Fungi, whilst the most remarkable species of the latter live on animal refuse; thus *Onygena equina* has its special habitat on the hoofs of the horse, and the *O. piligena* on the hair and skin of dead Mammalia.

The other families of Fungi exhibit in regard to habitats (*stations*) many remarkable examples. The species of the subgenus *Hypomyce*, belonging to *Hypocrea*, form a lining to the

hymenium of various Hymenomycetes; but they only show themselves in certain years peculiarly favourable to the production of Fungi, and then they ordinarily occur in great abundance. How and where their spores are preserved in the intervals of these recurrent appearances is a question that cannot be satisfactorily answered. Several species are epizöic, as, for example, some species of *Cordiceps* among the Pyrenomycetes, and sundry *Isaria* among the Gymnomycetes,—the examples of the genus first named living upon the larvæ of insects, whilst those of the second live upon perfect insects. Only one example of an epizöic Hymenomycetes can be adduced, viz. *Agaricus* (*Clitocybe*) *cerussatus*, γ. *nauseosus*, which has been met with in Russia on the carcase of a wolf; this habitat may, however, have been merely accidental.

The Myxogastres exhibit, with reference both to their habitats and to their entire development, a striking contrast with other natural families among the Gasteromycetes. They are frequently destitute of a visible *matrix*; their spores, in the course of development, form a drop of mucilage, which, in certain species, augments with incredible rapidity, and assumes a very great variety of shapes: of the most remarkable types among these are those which protrude vein-like rays, which spread themselves outwards over surrounding bodies, even on living plants, and by their ramifications produce a sort of network. These species often grow with such rapidity that the eye can with difficulty follow their increase, as is illustrated in *Diachea elegans*. The *Spumaria alba*, a common species of Myxogastres, hangs like a frothy mucoid mass to the stems of grasses*; and when fructification, or the actual Fungi make their appearance on this mycelium, they have neither the form, nor the consistence, nor the colour of the primitive mucus, but the whole organism assumes a yellow hue, whilst, too, its spores are black. Similar transformations largely prevail among the Myxogastres: hence it is necessary to follow attentively the different phases of their development, in order to avoid the mistake of constructing several species out of any one of them.

* Dr. W. Nylander, the translator of Fries's memoir into French, appends the following note to these remarks:—"From the not very correct manner in which Fries here speaks of the Myxogastres, and especially of the *Spumaria alba*, it might be suspected that his views respecting these Fungi are not very exact. Some readers might even suppose that an imperfect examination had led him to confound the mucoid mass which conceals the larva of *Cercopis spumaria* with the earliest phase of development of the *Reticularia alba*—a Fungus certainly less common in Sweden than the homopterous insect above named: at least, the preceding remarks of Fries concerning the first stage of *Spumaria* apply with more truth to the singular product from the *Cercopis*."

After these general observations, we will now proceed with a more detailed exposition of the geographical distribution of the principal genera of Hymenomycetes and Gasteromycetes, with respect to which it is often very difficult to decide whether their centre is in the tropical or the temperate zone.

III.

The most important family in the immense class of Fungi is without question that of the Hymenomycetes, which far excel all other Fungi both by the richness of their organization and the beauty of their forms. We have already mentioned the principal distinction which prevails extensively between the Hymenomycetes of the south and those of the north, the fleshy species predominating in the colder and the ligneous in the hot zone. Another circumstance to be noted, on making a comparison of the *Hymenomycetes pileati* of Europe with those of countries out of Europe, is, that while the differences obtaining between the specific types is considerable, there are few or none to be found between the several tribes; and further, the genera are always the same.

The genus *Agaricus* occupies the first rank among the Agaricinæ, and surpasses in the number of its species all the other generic groups known. In the present state of our knowledge, it appears to be well established that the *Agarici* have their geographic centre in the temperate zone, and especially in the colder portion of that zone, as though nature had destined them in those regions for the nourishment of their inhabitants; in fact, they largely serve this purpose in many countries, such as Hungary, Russia, and in general all the Slavonic territories. In Sweden alone, from the domination of vulgar prejudices, are their useful purposes overlooked and ignored. It is a curious circumstance that all the extra-European species of this genus *Agaricus* may be referred to various European subgenera.

In tropical countries it appears that the *Agarici* occupy only a secondary position in relation to other genera of Fungi, such as *Polyporus*, *Lenzites*, &c. North America, on the other hand, is richer in species of *Agaricus* than Europe; for, whilst the majority of typical forms are common to both continents, America further possesses many species peculiar to itself. In the temperate zone, so close is the analogy prevailing between the various countries in respect to the Agaricinæ, that from Sweden to Italy, and as well in England as in North America, the same species are to be found. Of five hundred Agaricinæ met with in St. Petersburg, there are only two or three which have not been discovered in Sweden; and again, of fifty species known in Greenland, there is not one that is not common in Sweden.

The same remarks hold good in reference to the Agaricinæ of Siberia, Kamtschatka, the Ukraine, &c. The countries bordering upon the Mediterranean possess, however, several peculiar types; and Eastern and Western Europe present certain dissimilarities in their Agaric inhabitants. Several species, for example, of *Armillaria* and *Tricholoma* which have been found in Russia have been met with in Sweden only in Upland, that is, in its most eastern province; all the species which belong to the so-called *abieigno-rupestres* and *pineto-montanæ* regions of Sweden are wanting in England; and it is only in Scotland that the species of our northern mountainous and pine-bearing region are met with—a circumstance explicable from the similarity in physical features between Sweden and the northern portions of Great Britain.

The species of *Coprinus* appear to find suitable habitats in every quarter of the globe.

The *Cortinariæ* predominate in the north: they abound in our latitude, especially on wooded hills; but the plains offer also some peculiar species, which germinate during the rainy days of August and September. In less cold countries they are more scarce, or entirely absent. The species of the genus *Hygrophorus* would at first seem to have a similar geographical distribution to those of the last group: but this is really not the case; for the same *Hygrophori* are to be found in nearly every country of Europe, and even the hottest countries (and those under the equator) are not destitute of representatives of this wide-spread genus.

The *Lactarii*, which are so abundant in the forests of Europe and North America, appear to grow more and more scarce towards both the south and the north. The same may be stated in regard to *Russula*.

The genus *Marasmius* is dispersed throughout the globe, and everywhere presents numerous species. In intertropical countries they are still more abundant, and exhibit peculiarities in growth which probably might justify their collection into a distinct group.

The genera *Lentinus* and *Lenzites* are found in every region of the world; their principal centre, however, is in hot countries, where they attain a splendid development. On the contrary, towards the north they rapidly decrease in number.

The *Polypori* constitute a group which, unlike that of the Agarics, especially belongs to hot countries: the *Boleti* constitute the only exception to this rule, since they select the temperate and frigid zones for their special abode, and some of them at times find their way to the higher regions of the Alps. No one can describe the luxuriance of the torrid zone in *Polypori*

and *Trametes*, genera of Hymenomycetes which flourish beneath the shade of the virgin forests, where perpetual moisture and heat promote their vegetation and give rise to an infinite variety of forms. But though the genus *Polyporus*, which rivals *Agaricus* in the number of its species, inhabits in preference warm climates at large, it nevertheless exhibits species peculiar to each country. This arises from the circumstance that the *Polypori* for the most part live upon trees, and are dependent on this or that particular tree for a suitable habitat; and the tropical flora being prolific in trees of all kinds, a multitude of the most varied forms of these Fungi is a necessary consequence. *Hexagona*, *Favolus*, and *Laschia* are common in intertropical countries, but none of them grow in temperate climes.

When the majority of the species of a genus are of a fleshy consistence, it may generally be concluded that that genus belongs to a northern region, even if it should have some representatives in lands which enjoy more sunshine. Thus the *Hydne* are the principal ornaments of our forests, where they attain so luxuriant a growth and beauty that every other country must yield the palm to Sweden in respect to them. In an allied genus, that of *Irpex*, the texture assumes a coriaceous consistence, and we find its species to be more especially inhabitants of warm climates.

Most of the genera of Auricularini are cosmopolitan; and the same is true of some species of *Stereum*, of *Corticium*, &c., which are met with in countries of the most different geographical position. In tropical countries, these genera of Fungi assume the most curious and luxuriant forms. The single and not considerable genus *Cyphella* appears to be pretty uniformly distributed over the globe. The *Clavarini* are equally universal in their diffusion, although more plentiful in the north; however, the genus *Pterula* possesses several exotic forms, though in Europe it has but two representative species. That beautiful genus of Hymenomycetes, *Sparassis*, occupies a similar place next the *Clavarini*, and is peculiarly a production of the temperate zone and of the Coniferous region.

The Fungi which constitute the family of Tremellinei prevail in Europe, Asia, and North America, and exhibit no marked differences among themselves, notwithstanding the distances of the several countries apart. It must, however, be stated that the *Hirneolæ* inhabit only the tropics.

We come now to the Gasteromycetes—an interesting family, which exhibits several ramifications or particular series of developments. The most perfect Gasteromycetes almost exclusively belong to the warmer division of the temperate, and to the tropical zone, where their vegetation is the most luxuriant. Of

late the catalogue of these Fungi has been greatly enriched by the addition of numerous genera and species proper to hot countries, previously unknown. Not uncommonly the exotic floras differ from ours not merely in respect of the species, but also of the genera of Gasteromycetes. It must, besides, be observed that this family is rich in well-defined genera, though very poor in distinct specific forms. Among the genera found in Europe, many are cosmopolitan.

The *Phallodei* present themselves in the torrid zone under the most varied form and colouring, and comprise many genera rich in species. In Europe their number is very restricted. As we advance northward, they decrease rapidly, so that the central districts of Sweden possess only a single species, the *Phallus impudicus*, and even this solitary representative of the family is very scarce. In Scania, the most southern province of Sweden, there is likewise but one genus and one species belonging to it, viz. the *Mutinus caninus*. Among other members of the *Phallodei* may be further mentioned the *Lysurus* of China, the *Ascroë* of Van Diemen's Land, and the *Clathrus*, one species of which, the *C. cancellatus*, has a very wide geographical range; for instance, it is found in the south of Europe, in Germany, and in America; whereas the other species of this genus have a very limited distribution.

The *Tuberacei* are remarkable among the Fungi in being all of them more or less hypogæous. They are natives of warm countries, and are distributed into numerous genera and species. The *Tuberacæ*, equally with the *Tuberci*, constitute in our latitude a group of Fungi very poor in specific forms. The few species of the *Hymenogastres* belonging to Sweden, with the exception of *Hyperrhiza variegata* and one example of the genus *Octaviania*, are confined to the southern provinces. The greater part of this group, like the *Lycoperdacei*, are met with in the temperate zone. Most examples of the genus *Lycoperdon* are cosmopolitan.

The *Nidulariacei* and the *Trichodermacei* appear to be scattered over the globe in a uniform manner, although their species are not everywhere similar. The same statement applies to the *Myxogastres*, which are common in Lapland, and appear to have their central point of distribution in the countries within the temperate zone. At the same time, they are not wanting in tropical regions, notwithstanding that the intensity of heat, by drying up the mucilage which serves as the medium for the development of their spores, is opposed to their development.

XXXI.—On *Goupia*. By JOHN MIERS, F.R.S., F.L.S. &c.

THE place which this little-known genus should occupy in the system has not yet been satisfactorily established, although its typical species was described and figured by Aublet (Pl. Guy. i. 296, tab. 116) more than eighty years ago. Willdenow considered it to belong to the *Araliaceæ*. Jussieu placed it in *Rhamnaceæ*—a view that was afterwards adopted by most botanists. Endlicher, however, classed it among the dubious genera of *Celastraceæ*, which opinion was followed by Dr. Lindley in his 'Vegetable Kingdom' (p. 588). All these conclusions were founded on the drawing and description of Aublet, as no other botanist up to that time appears to have examined the genus. Mr. Bentham, however (in 1852), gave more ample details of its floral structure (Kew Journ. Bot. iv. 11), on which he founded an emended generic character. Notwithstanding the many interesting facts there communicated, he regarded its position in the system as still uncertain: he remarked that the alternation of the stamens with the petals favoured the opinion of its affinity with the *Celastraceæ*; but he considered that the structure of the ovary brought it nearer to the *Büttneriaceæ*, because it is crowned by five divaricated styles and its ovules are affixed to the axis of a 5-celled ovary. Recently (in 1861) Dr. Reisseck (in Mart. Flor. Bras. xxviii. p. 34) gives his opinion positively that *Goupia* differs in no respect from the *Büttneriaceæ*, except in its baccate fruit, and that its immediate affinity is with the *Büttneriaceæ* and *Theobromaceæ*: though speaking so decidedly, he cannot have examined the structure of the genus, as otherwise, I am convinced, he could not have come to this conclusion.

With all the respect due to so distinguished an authority as Mr. Bentham, I beg to suggest that *Goupia* offers very slender claims of affinity towards the *Büttneriaceæ*. My reasons are founded on the alternate (not opposite) position of the stamens with regard to the petals; that they are all free and isomerous, without any tendency to become monadelphous or to be double the number of the petals; its anthers are introrse (not extrorse), and the æstivation of the petals is strictly valvate (not convolutely imbricate); to which may be added, the umbellated disposition of its axillary flowers. This eminent botanist considered that the anthers are sessile upon the margin of a monadelphous staminal tube, whereas I have noticed that they are perfectly free, being furnished with distinct filaments, in no way connected together, and seated round the ovary within a cupular disk, as in *Calypso campestris*, Camb., and in *Hippocrataceæ**.

Before I proceed to indicate what I conceive to be the real

* St.-Hil. Flor. Bras. ii. 3, tab. 104.

position of *Goupia*, it will be necessary to detail minutely all that I have observed during a very careful examination of its floral and seminal structure. It has a small cup-shaped calyx covered with a dense short pile, and is deeply divided into five acute erect teeth, which have an imbricated æstivation. The corolla consists of five linearly oblong, glabrous, fleshy petals, more than six times the length of the calyx, their straight margins being deeply introflexed and valvate in æstivation; and their appendiciform apices, measuring half their length, are suddenly inflected and united together in the axis of the flower by their valvate margins; they originate in the bottom of the calyx outside and around the disk, being alternate with the calycine teeth; when the flower opens, they become horizontally expanded, with the inflected apices standing erect at right angles with them. The disk forms a notable feature in this structure, being nearly the size of the calyx, quite cup-shaped, with five very short teeth, which alternate with the stamens. The five stamens are erect, and stand *within* the disk, free from it as well as from the ovary; the filaments are short, subulate, and glabrous, supporting a much broader and thicker linear connective, which, extending beyond the anthers, is truncated at its summit, where it is furnished in front with a horizontal tuft of long hairs, its margins, behind the anthers, being ciliated with similar hairs: the anthers are bilobed, cordate at base, double the breadth of the connective, to which they are attached by their whole length; they are introrse, each lobe opening by a longitudinal and somewhat oblique fissure; one-half of each anther rises above the margin of the disk, and their long apical horizontal tufts of hair meet in the middle of the ovary, passing between the styles, thus serving as collectors to convey their pollen to them. The ovary is spherical, five-grooved, and somewhat depressed in the centre, where a small umbonate point is seen; and at some distance from this centre five distinct styles originate, which are rather short, very distant from each other, somewhat erect and divergent, there being no distinguishable stigmata, except their merely glandular points; the ovary has five equal complete cells ranged round a central axis, the dissepiments corresponding with the external grooves and alternating with the styles; there are several ovules in each cell, all standing erect and crowded together at the base of the inner angles of the cells. The fruit is spherical, and 2 lines in diameter; it has been incorrectly described as a berry, but its fleshy sarcocarp encloses an indehiscent 3-5-grooved, 3-5-celled nut, the walls and dissepiments of which, though very thin, are crustaceous; each cell contains one, more generally two or three, erect black seeds. The seed is oval when it is solitary, plano-

convex when there are two, or angular when there are three seeds in each cell: it is covered by a smooth and very fleshy tunic, marked on its ventral face by a prominent line; this cannot be an arillus, because it contains the simple chord of the raphe, which extends from a somewhat lateral and basal hilum to a small hollow in its summit, which it penetrates to reach the second tunic; it is analogous to the same kind of covering as that I have described in *Magnolia* and *Clusia*, and designated as an *arilline**, being a fleshy development of the primine of the ovule: the next is a hard testaceous shell, regularly oval, densely pitted by minute hollows arranged longitudinally in parallel lines; it cannot be the testa, because it has no raphe, being a growth of the secundine of the ovule; in its summit there is a hollow, with a small diaphylar hole, through which the chord of the raphe passes to reach the chalaza of the inner membranaceous integument or *tegmen*, which closely invests the fleshy albumen. The embryo is somewhat shorter than the albumen, in which it is imbedded, but is much narrower; the cotyledons are oblong-ovate and foliaceous, equal in length to the terete radicle, the extremity of which reaches the base, and is therefore close to the hilum of the seed.

We have here a structure which does not correspond in all its characters with any particular family, but which evidently belongs to the *Celastral* alliance. It agrees with the *Hippocrataceæ* in the position of its stamens within a cupular disk, but differs in the imbricate æstivation of its petals and in the position of its ovules. It accords with the *Celastraceæ* in its erect ovules originating in the base of the cells of the ovary, the external tunic of its seeds being an arilline, that is to say, a fleshy coating containing the vessels of the raphe, and covering an internal testaceous integument; but it differs in the position of its stamens in regard to the disk, and in the æstivation of its petals. It agrees with the *Icacinaceæ* in the æstivation of its sepals and petals, in the long apical inflection of the petals (as in *Mappia*, *Stemonurus*, &c.), in the hairy appendages of its stamens (as in *Stemonurus*), and in the number of cells in its ovary (as in *Emmotum*); but it differs in the position of its stamens with respect to the disk, and in its erect ovules and seeds.

If we maintain any consistency in our demarcations of the limits of these several families, *Goupia* cannot be admitted into any of them, and it must stand as the type of a distinct group, which I propose to call *Goupiaceæ*, distinguished by the following characters:—

* Linn. Trans. xxii. 80; Ann. Nat. Hist. 3 ser. iv. 26; Contributions to Botany, i. 211.

GOUPIACEÆ.—*Flores* hermaphroditi vel subpolygami. *Calyx* parvus, 5-dentatus, dentibus æstivatione imbricatis. *Petala* 5, linearia, æstivatione introflexo-valvata, apicibus longe propendentibus introflexis. *Stamina* 5, libera, introrsa, brevia, cum petalis alterna, intra *discum* cupuliformem hypogyna. *Ovarium* globosum, 5-loculare; *ovula* plurima in quoque loculo, erecta, et anatropa. *Styli* 5, subulati, breves, late segregati, subdivariati, cum dissepimentis alterni. *Stigmata* subnulla. *Drupa* globosa, carnosula; nux tenuissimus, 3-4-5-locularis, loculis 1-2-3-spermis. *Semina* erecta; *integumentum externum* (arilina) carnosulum, raphigerum, *raphe* simplici, dorsali; *integumentum secundum* testaceum, evasculosum. *Albumen* carnosum. *Embryo* orthotropus. *Cotyledones* foliaceæ; *radicula* teres, ad hilum spectans.

Arbores frondosi *Guianenses*; folia *petiolata*, *paucinervia*, *venis crebris*, *parallelis*, *transversis*; stipulæ *subulato-lineares*; flores *axillares*, *parvi*, *umbellati*.

On a former occasion, when discussing the question of the relative affinities of the *Icacinaceæ* with the *Celastraceæ*, *Hippocrataceæ*, *Aquifoliaceæ*, &c.*, and determining the position of the former in the system†, I exhibited in a tabular form the leading differential features of the several families that enter into the Celastral alliance. I now repeat the same under a more synoptical form, including the *Goupiaceæ*.

1. Æstivation of petals imbricate.

A. Stamens outside disk.

α. Ovules erect, with a ventral raphe, or suspended, with a dorsal raphe; seed albuminous *Celastraceæ*.

β. Ovules suspended ‡; seed exalbuminous *Chailletiaceæ*.

B. Stamens inserted inside or upon disk *Hippocrataceæ*.

C. Stamens hypogynous; disk almost obsolete.

α. Ovules suspended, with a dorsal raphe; cotyledons large in regard to radicle *Aquifoliaceæ*.

β. Ovules suspended, with a ventral(?) raphe; cotyledons small *Cyrillaceæ*.

2. Æstivation of petals valvate

A. Stamens inserted inside disk; ovules erect *Goupiaceæ*.

B. Stamens inserted outside disk; ovules suspended *Icacinceæ*.

I may here observe that an essential point in the development of the ovules and seeds in the several groups above enumerated is the relative position of the raphe. It has been shown that an erect ovule with a dorsal raphe is a mere resupination of a sus-

* Ann. Nat. Hist. 2 ser. viii. 167-169, ix. 220; Contrib. to Bot. i. 27-29, 50.

† Ann. Nat. Hist. 2 ser. ix. 221; Contrib. to Bot. i. 51.

‡ With a dorsal raphe, according to Agardh, Syst. 294.

pended ovule with a ventral raphe, and that a suspended ovule with a dorsal raphe is equivalent to an erect ovule with a ventral raphe, the former being a reversion of the ovule upon its funicle by the mere effect of pressure. These are distinctions of some value, which are generally neglected, but which ought always to be recorded. It will hence be seen that, although in one case the ovules are suspended and in the other erect, there is a nearer approximation in their development in the *Icacinaceæ* and *Goupiaceæ* than the position of the raphe at first sight indicates. This circumstance and the valvate æstivation of the corolla bring them into close proximity; but the insertion of the stamens in regard to the disk, the distantly separated styles, more numerous ovules and seeds, the nature of the seminal integuments, and other characters claim for the *Goupiaceæ* a very distinct position.

I offer here a more ample diagnosis of the genus under consideration founded on my own observations:—

GOUPIA, Aubl.; — Gupia, *Jaume St.-Hil.*; — Glossopetalum, *Schreb.*; — *Calyx* parvus, cupuliformis, 5-dentatus, dentibus acutis, æstivatione imbricatis. *Petala* 5, inter discum et calycem inserta, cum dentibus calycinis alterna, oblongo-linearia, apicibus longe attenuatis et inflexis, æstivatione e marginibus profunde introflexis valvata. *Discus* cupuliformis, calyce vix minor, inter petala et stamina enatus, omnino liber, glaber, dentibus 5 minimis remotis cum staminibus alternis margine instructus. *Stamina* 5, inter discum et ovarium inserta, cum petalis alterna, e basi erecta, omnino libera, discum paulo excedentia; *filamenta* brevissima, subulata, compressa, in *connectivum* latum apice truncatum ultra antheras extensum et hinc pilis longissimis patentibus intus instructum marginibusque pone antheras longe ciliatum summo expansa. *Antheræ* bilobæ, imo cordatæ, ad *connectivum* dimidio angustius dorso adnatæ, lobis ovatis, obliquis, utrinque rima longitudinali subintrorsum dehiscentibus. *Pollen* globosum, 3-sulcatum. *Ovarium* depressoglobosum, disco fere omnino occultum, liberum, glabrum, 5-sulcatum, apice umbone punctiformi signatum, 5-loculare; *ovula* in quoque loculo plurima, fasciculata, e basi ex angulo versus axin adscendentia, cum *raphe* ventrali. *Styli* 5, remotiusculi, subulati, breviusculi, subradiatim divaricati, cum sulcis et staminibus alterni; *stigmata* inconspicua, glandulosa. *Fructus* drupaceus, globosus, calyce immutato suffultus; *pericarpium* pergaminco-coriaceum, sulcatum, indehiscens, 3-4-5-loculare, dissepimentis sulcis oppositis, loculis 1-2-3-spermis. *Semina* e basi erecta, oblongo-ovata; *integumentum externum* (*arillina*) carnosulum, læve, *raphe* ventrali lineari immerso-prominente, hiloque fere basali parvo cavo

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notatum : *integumentum secundum* testaceum, durum, lineis creberrimis longitudinalibus rugulosis signatum, apice *chalaza* circulari parvula centro (pro raphes vasorum introitu) perforata instructum ; *integumentum internum* tenuissime membranaceum, pellucidum ; *albumen* solidum, carnosum. *Embryo* orthotropus, albumini paululo longiori immersus ; *cotyledones* ovali-oblongæ, foliaceæ, compressæ, *radiculæ* tereti ad basin attingenti subæquilongæ.

Arbores Guianenses et Brasilienses ; folia *alterna*, *ovato-lanceolata*, *integra*, *acuta*, *speciosim venosa*, *petiolata* ; stipulæ *utrinque lineares*, *acutæ*, *deciduæ* ; pedunculi *solitarii*, *axillares*, pedicellos *plurimos umbellatos 1-floros apice gerentes* ; flores *minimi*.

1. *Goupia glabra*, Aubl. Pl. Guian. i. 296, tab. 116 ; Lam. Dict. iii. 15, tab. 217 ; DC. Prodr. ii. 29 ; Benth. in Hook. Kew Journ. iv. 12 ; Reisseck in Mart. Flor. Bras. fasc. 28. p. 34 ;—Glossopetalum glabrum, Schreb. Gen. Pl. No. 526 ; Willd. Sp. Pl. No. 588 ;—arbor excelsa, ramosa ; ramulis angulato-striatis subflexuosis ; foliis ovato-lanceolatis, acuminatis, integris, basi inæqualibus, utrinque glabris, nitidis, nervis utrinque 3–4 remotis obliquis, 2 inferioribus suboppositis, venis creberrime parallelis et transversis reticulatis speciosim signatis, subtus minutissime albo-punctulatis ; petiolo tereti ; stipulis linearibus, caducissimis ; pedunculis axillaribus, solitariis, petiolo sub-brevioribus, pedicellis illis longioribus gracillimis 20–24 umbellatis, unifloris, imo bracteolatis ; fructu globoso, carnosio, piperis magnitudine.—Cayenne et Brasilia Septentrionalis, v. s. ; prope Panuré, Rio Uaupes (Spruce, No. 2624).

One of the most conspicuous features in this plant is the elegant disposition of the veins in its leaves, greatly resembling in this respect the leaves of *Poraqueiba Surinamensis**, belonging to the *Icacinaceæ*. The internodes are about $\frac{3}{4}$ inch apart ; the leaves are 4–5 inches long, 1–2 inches broad, on a petiole 4 lines in length ; the stipules are 4 lines long, $\frac{1}{2}$ line wide ; the peduncle is 3–4 lines, the pedicels 6 lines long ; the calyx is $\frac{1}{2}$ line long ; the petals are 4 lines long (including the inflected apex of 1 line) ; the drupe is 2 lines in diameter †.

2. *Goupia tomentosa*, Aubl. loc. cit. ;—Arbuscula, precedenti sub-similis, cortice foliisque valde amaris ; foliis utrinque hirsutis. —Guiana et Ins. Cayenne.

* Contributions to Botany, vol. i. pl. 10.

† This species, with full analytical details, will be represented in the 'Contributions,' vol. ii. Plate 74.

XXXII.—On some new Species of Mollusca from Japan.

By ARTHUR ADAMS, F.L.S. &c.

Genus KLEINELLA, A. Adams.

Kleinella sulcata, A. Adams.

K. testa oblonga, tenui, turbinata, profunde umbilicata; spira elata, conoidea, sordide alba, transversim sulcata, sulcis distantibus, interstitiis longitudinaliter concinne striatis; anfractibus $3\frac{1}{2}$, planis, superne angulatis; anfractu ultimo ventricosus; apertura oblonga, antice eversa et subeffusa; labro tenui, postice angulato.

Hab. Suwonado Sea; 7 fathoms.

Genus CYRILLA, A. Adams.

Cyrilla decussata, A. Adams.

C. testa oblonga, obliqua, vix inæquilaterali, alba, solida; costellis radiantibus et lirulis concentricis confertim decussata; cardinis dentibus posterioribus in laminas non desinentibus.

Hab. Gotto Islands; 48 fathoms.

Genus MUCRONALIA, A. Adams.

Mucronalia exilis, A. Adams.

M. testa parva, subulata, graciliore, apice subito mucronato, recta, tenui, alba, polita, semiopaca, linea spirali angusta rufo-fusca ornata; anfractu ultimo lineis duabus succincto; apertura elongato-ovata.

Hab. Simonoseki, Suwonado Sea; 7 fathoms.

Genus APICALIA, A. Adams.

Testa distorta, polita, imperforata, subulata; anfractibus irregularibus, supremis in mucronem dispositis. Apertura oblonga; labio simplici.

This form of *Eulimida* bears the same relation to *Eulima* that *Mucronalia* does to *Leiostraca*. It is milk-white, without any coloured markings, and the whorls are distorted; but it has the very peculiar mucro observed in *Stylifer* and *Mucronalia*.

Apicalia gibba, A. Adams.

A. testa obliqua, elevato-conoidea, alba, solida, vix opaca; anfractibus normalibus 4, convexis, subgibbosis, supremis angustatis in forma mucronis dispositis; apertura obliqua, ovata; labio subincrassato.

Hab. Gotto Islands; 71 fathoms.

Genus NISO, Risso.

Niso interrupta, Sow.

Animal milk-white. Tentacles flat, subulate, diverging, ob-

tuse at the tips, not folded or ear-like, margined with pale black. Eyes small, black, and sessile at the outer bases of the tentacles just within the margin of the head. Head bordered with pale black. An oblique pale-black line extends from the lower part of the neck down the side, ending at the operculigerous lobe, which is large, thick, and closely applied to the under surface of the last whorl.

Hab. Simonoseki; 7 fathoms.

Genus *SCALA*, Klein.

Scala soluta, A. Adams.

S. testa pyramidali, acuminata, alba, glabra, pellucida; anfractibus disjunctis, angustis varicibus 6 distantibus laminatis simplicibus prope suturas in angulum productis; apertura circulari.

Hab. Port Lindsay; 15 fathoms.

This pretty species has the loosely rolled whorls and form of *S. hyalina*, Hinds, and the simple varices of *S. laxata*, Sow.

Genus *ISANDER*, H. & A. Adams.

1. *Isander maculosus*, A. Adams.

I. testa globoso-conoidea, solida, anguste umbilicata, alba, polita, superne transversim sulcata maculis rufo-fuscis ornata; anfractu ultimo ultra peripheriam angulato; apertura subquadrata; labio rectiusculo, antice dilatato; umbilico angusto, margine crenulato-rugoso.

Hab. Gotto Islands; 71 fathoms.

2. *Isander crenelliferus*, A. Adams.

I. testa globoso-turbinata, late umbilicata, alba, solida, semiopaca, longitudinaliter plicato-rugosa, suturis canaliculatis; anfractibus ad suturas crenulatis; apertura subcirculari; labio incrassato, arcuato; umbilico margine crenato.

Hab. Gotto Islands; 71 fathoms.

Genus *ETHALIA*, H. & A. Adams.

1. *Ethalia candida*, A. Adams.

E. testa depresso-turbinata, alba, solida, opaca, transversim regulariter valde striata; anfractibus $2\frac{1}{2}$, planulatis; apertura circulari; labio callo expanso umbilicum vix tegente; umbilico margine crenato-rugoso.

Hab. Gotto Islands; 71 fathoms.

2. *Ethalia polita*, A. Adams.

E. testa orbiculato-conoidea, alba, lævi, polita, vix opaca, spira sub-

conica, basi convexa, callo crasso obtecta; anfractibus sub lente obsolete transversim striatis; apertura circulari, peritremate continuo; labio incrassato.

Hab. Gotto Islands; 71 fathoms.

Genus SEMICASSIS, Klein.

Semicassis japonica, Reeve.

Animal light pink. Head long, narrow, flattened. Tentacles subulate, flattened, broad at the base, pale yellow, with opaque-white tips and with a dark-brown tapering marginal stripe. Eyes very large and black, without pupils, on slight swellings at the outer bases of the tentacles. Edge of foot narrowly margined with greenish yellow.

Hab. Gotto Islands; 71 fathoms.

Genus CYLLENE, Gray.

Species incerta.

Animal semipellucid, white, with an opaque-white stripe along each side of the upper surface of the foot, and two short diverging stripes of the same colour on the upper part immediately behind the operculum. Head broad, triangular, and depressed; tentacles long, filiform, diverging. Eyes large and black, on swellings at the outer bases of the tentacles. Siphon recurved, moderate. Foot large, broad, with parallel sides, straight and auriculate on each side in front, and truncately rounded behind, bearing the operculum obliquely; the hind margin simple.

Hab. Satanosaki, south coast of Kiusu; 55 fathoms.

Genus CRYPTA, Humphrey.

Crypta lamellosa, A. Adams.

C. testa depressa, orbiculari, lamellosa; apice parvo, spirali, postico, submarginali; lamellis dorsalibus concentricis, rugosis, confertim imbricatis; septo interno postico, angustato, curvato; margine libero concavo.

Hab. Gotto Islands; 48 fathoms.

A small, flat, orbicular, lamellose species, with a narrow concave septum.

Genus TURRICULA, Klein.

Turricula (Costellaria) pyramidella, A. Adams.

T. testa pyramidali-turrita; spira producta, attenuata; anfractibus $6\frac{1}{2}$, planatis, supremis parvis angustatis, longitudinaliter costatis, costis rectis distantibus, interstitiis transversim liratis; apertura subtriangulari; labio recto, plicis tribus obliquis spiralibus in-

structo; labro margine in medio obtusim angulato; colore fulvicante.

Hab. Satanosaki, south coast of Kiusu; 55 fathoms.

Genus ZEIDORA, A. Adams.

On comparing my examples of this curious little genus, I observed that I had confounded two species under the name *calceolina*. The second of the two I beg leave now to describe under the name of

Zeidora reticulata, A. Adams.

Z. testa oblonga, dorso convexa, lineis elevatis longitudinalibus radiantibus et lirulis concentricis pulcherrime decussata; apertura margine crenulato, fissura profunda angusta.

Hab. Mino-Sima; 63 fathoms.

This species differs from *Z. calceolina* in being much more convex, less obtuse anteriorly, and in the fissure being narrow and deeply incised. The sculpture, moreover, is very different, the surface being finely reticulate instead of widely cancellate.

Yokubama, August 11, 1861.

XXXIII.—*Note on the Molluscan Fauna of Japan.*

By ARTHUR ADAMS, F.L.S. &c.

WITH regard at least to the Molluscan fauna, the Manchurian province, indicated with doubt by Professor Edward Forbes in his 'Map of the Distribution of Marine Life,' does not exist.

The Japonian province is bounded on the north by the Okhotskian and on the south by the Indo-Pacific province, and it receives contributions from both. *Littorina grandis* and *subtenebrosa*, *Cryptochiton Stelleri* and *Amicula amiculata*, for example, have travelled south from the Sea of Okhotsk; while *Littorina sinensis* and *Acanthochites scutiger* have come northward from the Yellow Sea. The great northern species of *Neptunea* and *Buccinum* and the *Velutina* family abound and flourish towards its northern boundary, while to the south linger vestiges of the great tropical families of Cowries, Olives, and Cones. The neutral ground, or place of meeting of north and south, seems to be near the Strait of Tsuka, or the south end of Yesso and the north of Nippon.

Some genera and species have only been met with hitherto in the Sea of Japan, and are possibly peculiar to the Japonian province; at least we must consider them indigenous to this sea until they shall have been detected elsewhere. Examples of this occur in the genera *Zeidora*, *Cranopsis*, *Morchia*, *Cyrella*, and

Enida, which I have recently discovered, and in the species *Eburna japonica* and *Haliotis japonica*.

The remainder, or possibly the greater part, of the Molluscan inhabitants have been introduced by foreign immigrations from the north, south, and west.

1. *Boreal or Northern Forms.*

These have travelled from the Sea of Okhotsk, passing through the Strait of La Pérouse, and, following the prevailing cold current, according to our observations, have distributed themselves along the coast of Manchuria and the shores of Yesso. Some of these, for example *Cryptochiton Stelleri* and *Littorina grandis*, may have been derived from the Shantar Sea, having passed through the Gulf of Amur into the Gulf of Tartary.

2. *Indo-Chinese or Southern Forms.*

These, issuing from the China, Eastern, and Yellow Seas, have entered by the Korea Strait, and, following the prevailing warm current along the shores of Nippon, have spread themselves over the Sea of Japan, mingling with species from the north and west.

3. *Pacific or Western Forms.*

These mollusks have crossed the North Pacific Ocean, and passed into the Sea of Japan by the Straits of Tsuka and La Pérouse. Among them may be instanced *Saxidomus Nuttalli* and *Gemma gemma*. Saghaleen has derived some species from Sitka, the Manchurian coast from Oregon, and the islands of Yesso and Nippon from California.

I can say nothing from personal observation concerning the influence of the gulf stream of the North Pacific, but possibly during the summer of the present year I may have an opportunity of visiting the western coast of Nippon.

Shanghai, China, May 15, 1861.

XXXIV.—On a Species of *Rüppellia*, Milne-Edwards, and the Limits of the Brachyura. By Dr. STRAHL*.

DANA, in his work on the Crustacea, describes a *Rüppellia* which he identifies, with doubt, with *R. annulipes*, M.-E. The figure given by him facilitates a comparison with the statements of Milne-Edwards. Dana's *Rüppellia* is evidently a new species, and not to be identified with any one of Milne-Edwards's three species. The species described as *Rüppellia annulipes* by Dana

* Translated from the Monatsbericht der Königl. Akad. der Wiss. zu Berlin, November 1861, p. 1004.

I propose to name *R. truncata*, because the frontal margin is not distinctly toothed, but almost entirely smooth as in *R. vinosa*, M.-E. *R. truncata* is further distinguished from *R. annulipes*, and also from *R. vinosa*, by the lower margin of the orbit bearing four small teeth, and from *R. annulipes*, M.-E., by the want of the horizontal ridge upon the teeth of the lateral margin, by which the latter is specifically distinguished.

The genus *Rüppellia* consequently includes four well-marked species. The *Cancer Calypso*, Herbst, which Milne-Edwards supposed might belong to *Rüppellia*, belongs to the genus *Pilumnoides*, Dana. *Rüppellia* is most nearly allied to *Ozius*, Leach; for, besides that, as Dana has already pointed out, the *spatium pralabiale* is distinctly divided on each side by a longitudinal seam, and the efferent canal of the branchial canal thus bounded, corresponding to the anterior margin of the third joint of the external maxillipeds, exhibits a round emargination, the form of the first joint of the external antennæ agrees in *Ozius* and *Rüppellia*; this joint, in its course from behind forwards, is bent in the form of a knee from within outwards. The agreement in external structure is so great in the two genera that they might conveniently be united in a single one, but for the presence of a distinction which refers each of these genera to a particular division. Thus, in *Rüppellia* the pterygostomium and forehead come so close together that the orbit is thereby completely closed internally, as in *Eriphia* and *Trapezia*; whilst these parts in *Ozius* leave a cleft between them, in which, as in the allied genera *Galene*, *Pilumnus*, &c., the moveable portions of the external antennæ conceal themselves.

Dana's *Ozinae* enable the *Eriphinae* to be approximated to the *Xanthinae* and *Chlorodinae*, in so far as in the *Ozinae*, *Xanthinae*, and *Chlorodinae*, and likewise in the *Portunidae*, the pterygostomium never closely approaches the forehead, and completely closes the orbit internally, but a wider or narrower cleft always remains here; if the orbit be nevertheless closed internally, this is always effected by the first joint of the external antenna, which is then of large size, as in *Melissa* (*Euxanthus*, Dana), *Etisus*, *Thalamita*. The *Eriphinae* might probably be arranged next to the *Oxyrhyncha*, which I formerly limited more accurately as *Brachyura perfusa*; in the latter the amalgamation of the pterygostomium with the first joint of the external antenna and with the epistomium effects the complete closure of the orbit, and the second joint of the antenna is always inserted at the summit and in front of the orbit.

As I have already indicated, the group of *Brachyura incuneata* established by me includes by far the greater part of the Brachyura; and decided differences of organization call for a further

division of them. The *Incuneata* break up into the *Cancroidea*, *Grapsoidea*, and *Leucosiæ*. The structure of the maxillipeds and respiratory apparatus, and also the position of the male sexual organs, are the grounds of this classification. Dana has set up the *Corystoidea* also as a peculiar type; but these must be united with the *Cancroidea* with even more justice than the *Thelphusinae*, especially as the most multifarious transitions occur within the *Cancroidea*,—as the genera *Paraxanthus*, Lucas, *Platycarcinus*, M.-E., and *Perimela*, Leach, unless the last-mentioned genus must be entirely removed to the *Corystoidea*.

The *Leucosiæ* I consider to include only Dana's *Leucosidæ*, with *Dorippe* and *Æthusa*. I separate the *Calappidæ* and *Matutidæ* from them, and unite them with the *Parthenopinae* rejected from the *Oxyrhyncha*, whilst *Oncinopus* must be placed amongst the *Liberata* in the neighbourhood of *Hymenosoma*. This combination is justified by the agreement in the situation of the afferent canal of the branchial cavity and of the male sexual organs; and a close affinity is also shown by the strongly keeled claws, of which the hands are usually long: moreover, the forehead is not divided at the point of attachment of the first joint of the external antenna, but this joint is merely squeezed in between the pterygostomium and the first joint of the inner antenna, the other parts of it are fully moveable, and thus, as it were, a step is made towards the *Liberata*. In this section the *Parthenopinae* approach nearer to the Cancroid type, and the *Matutidæ* and *Calappidæ* to the Leucoside type, in regard to the structure of the outer maxillipeds. Here belongs undoubtedly the genus *Zebrida*, Adams and White, as appears from the figure in the 'Voyage of the Samarang,' and, with some doubt, also *Harrovia*, Adams and White, of which no inferior view is given. The same arguments apply to *Ceratocarcinus* and *Gonatonotus*, Adams and White; nevertheless *Gonatonotus* appears rather to be Cancroid so far as the form of the claws allows one to judge. In estimating the relations here indicated by me, both figures and descriptions unfortunately frequently fail one.

The *Grapsoidea* are formed naturally only of those of Dana's *Grapsoidea* which remain after the separation from them of the families formerly named by me as *Liberata*. The genus *Grapsus*, limited by the rejection of *Leptograpsus*, *Metopograpsus*, &c., and represented by the species *Pharaonis*, *strigosus*, *Webbii*, &c., must be removed not only out of the *Grapsoidea*, but even entirely out of the Brachyura, because the structure of the external antennæ differs completely from that which prevails amongst the Brachyura. *Grapsus*, namely, has no operculum at the base of the external antennæ, but a perforated tubercle, as in the *Macrura*, and must therefore at least be placed among the Ano-

mura, somewhere in the vicinity of the *Dromidæ*; in any case it forms a particular section, on account of the position of the female sexual organs.

The external antenna is not suspended immediately from the cephalothorax, like the internal antenna, but by means of an articular piece, which is called "*article basilaire*" by Milne-Edwards in the Macrura. This articular piece is not a complete ring, but only a half-ring, which moves by its ends in a hinge-joint, and fulfils a double function. It not only bears the external antenna with its subsidiary organ, the antennal scale, but also contains the efferent orifice for the secretion of Suckow's gland. The latter point has been confirmed by the malformation discovered by me, and described in Reichert and Du Bois-Reymond's '*Archiv*' (1859, p. 333), but I wait for further corroboration. In all Macrura and Anomura this articular piece possesses a *tubercle*, which is perforated at the summit and closed by a membrane, the so-called *tympanum*. But this tympanum has a slit in its centre, which may be opened and closed by muscular action. This slit leads, by a tube of greater or less length, to the so-called auditory vesicle, which collects the secretion of the green gland.

This structure is shown by the articular piece throughout, even if the antennal scale be entirely wanting, as in the *Palinuridæ*, the *Scyllaridæ*, the *Galatheidæ*, the *Porcellanidæ*, the *Hippidæ*, and the *Raninidæ*. In the *Porcellanidæ* this piece is still of considerable size, but in the *Dromidæ* it becomes so shrunk that essentially only the tubercle remains, but this fully developed. In *Dromia* the tympanal membrane is very small, but still the slit is apparent; and *Grapsus* sensu strictiore has the same structure. The Brachyura show no trace of antennal scale; and from the *Dromidæ* to them is only a step. Thus, if we imagine the slit in the tubercle of *Dromia* carried out to one side, so that here the peripheral margin is completely separated, we have the operculum of the Brachyura in its perfect form: for this operculum by no means possesses a construction comparable to that of the stapes in the auditory organs of the higher animals; it is rather a valve, which is attached externally to the pterygostomium, and can be opened in the direction of the median line of the animal; its opening and closing is subject to the will; and for this purpose the operculum possesses on its inner margin a manubrium ascending into the interior of the animal, to which the muscles are attached. I have fully investigated this structure in both *Carcinus Menas* and *Platycarcinus Pagurus*, and found in these also that a reservoir is reached, likewise situated in front of the stomach, and connected with a glandular organ, which is the apple-green organ (Suckow's gland).

If *Grapsus* is to be entirely removed from the Brachyura, the name *Grapsoidea* cannot be retained for a Brachyurous group. In the group in question, *Planes*, Leach (*Nautilograpsus*, M.-E.), is the oldest genus; and I therefore provisionally give this group the name of *Planidæ*. But I also give up the name of Brachyura altogether; for *Grapsus* and the *Dromidæ* are Brachyura in respect of their abdomen. I rather group together all those Decapoda of which the external antenna exhibits an operculum, as *Opercularia*, and call all the remainder *Tubercularia*, because their outer antenna presents a tubercle. I consequently also get rid of the section Anomura, which hitherto included the forms which, in regard to the structure of the abdomen, constituted the transitions from the Macrura to the Brachyura. With respect to the structure of the external antennæ, the Anomura agree throughout with the Macrura: even the *Lithodidæ* and *Paguridæ* exhibit more or less of the antennal scale.

The Opercularia consequently include all the genera cited by Dana as Brachyura, with the exception of the genus *Grapsus* in the restricted sense; but, in compensation, the *Bellidea*, placed by Dana amongst the Anomura, fall into this group.

XXXV.—*A Catalogue of the Zoophytes of South Devon and South Cornwall.* By the Rev. THOMAS HINCKS, B.A.

[Continued from p. 207.]

Fam. Celleporidæ.

CELLEPORA, Fabricius.

Section α . *Encrusting, adnate.*

1. *C. pumicosa*, Linnæus.

Very common, on stones, shells, *Sertulariadae*, &c.

This species is of very variable aspect. Sometimes it forms small oval masses on the stems of Zoophytes. This is the condition figured by Mr. Busk (Catal. pl. 110. fig. 4). When developed on the surface of shells, &c., it forms somewhat circular *mounds*, raised in the centre and sloping off towards the edge. Sometimes it occurs in irregularly-shaped porous masses, of very considerable size, involving more or less the fragment of shell or other body which constituted the original support of the polyzooary. A specimen of this description from Torbay measures about $3\frac{1}{4}$ inches in length, $2\frac{1}{2}$ inches in width, and $1\frac{1}{4}$ inch in thickness.

Much as this differs in general appearance from the smaller

varieties, I can find no distinction between them in the minute characters.

2. *C. Hassallii*, Johnston.

Occasional, on shells and stone; on *Anomia* from Plymouth; on stone from 30 fathoms, Cornwall (very fine), &c.

3. *C. edax*, Busk, 'Polyzoa of the Crag,' p. 59, pl. 9. fig. 6,
pl. 22. fig. 3.

On a *Turritella* (?) from Plymouth.

Of this very curious form I have only obtained the single specimen referred to by Mr. Busk in his 'Monograph;' and I am not aware that any other *recent* example has occurred. It seems to be not uncommon in the Coralline Crag.

The Devonshire specimen, which has been moulded on a small univalve shell, probably a *Turritella*, is in very fresh condition, and shows the minute characters well. Like its fossil kindred, the Cellepore has completely removed the substance of the shell on which it originally took up its abode. Nothing now remains but the *form*, which is perpetuated by the stony crust of the Polyzoan.

A strictly analogous case occurs amongst the *Actinozoa*. A *Zoanthus* has been described by Düben and Koren, under the name of *Mamillifera incrustata*, which is commonly parasitic on shells that are tenanted by a species of *Pagurus*. In all cases, however, the shell is destroyed after a while by some process of erosion or absorption, the diffused basal crust of the Zoophyte forming a perfect cast of it, and affording shelter to the crab. This form occurs in Shetland and the north of England, as well as in Norway, and is regarded by Mr. Gosse as a variety of *Z. Couchii*. Taking into account, however, the differences in the number and colour of the tentacles, which the northern naturalists have pointed out, and in the characters of the base, as well as the remarkable peculiarity just referred to, I am inclined to regard the *M. incrustata* as a distinct species.

4. *C. avicularis*, Hincks. Pl. XII. figs. 6, 6a.

'Microscopical Journal,' vol. viii. p. 278.

Common, encrusting the stems and branches of Zoophytes from deep water, with large and nodulous rolls. The *Gorgonia* is frequently laden with masses of it.

This is one of the best-marked of the crustaceous Cellepores—a most perplexing tribe to deal with. After the repeated examination of a multitude of specimens, I find myself quite unable to speak with confidence as to the forms which are entitled to specific rank; indeed the bewilderment increases with the number of specimens examined.

The *C. avicularis*, however, is well marked and readily recognized. The cells are crowded, erect, uneven, some being elevated considerably above the others; the orifice orbicular above, with a pointed sinus below; the peristome elevated into a border, and rising in front into a rostrum, which bears an oval avicularium on one side of it; ovicell prominent, subglobose, punctured—generally an ascending process on each side of it, bearing a small oval avicularium; here and there amongst the cells, large mounted avicularia, with broad triangular mandible; spatulate avicularia distributed over the surface of the polyzoary. The number and variety of the avicularian appendages in this species are remarkable.

Numerous circular apertures are distributed over the polyzoary amongst the cells.

5. *C. tubigera*, Busk, 'Crag Polyzoa,' p. 60, pl. 22. fig. 2.

To this species I refer (not without some doubt) two specimens obtained from Plymouth. They form subconical masses, the surface of which is covered with irregular prominences. The cells are distant and very distinct, sometimes connected by ridges, punctured round the orifice; orifice orbicular, with a sinus below; a process in front, bearing, near the top, an oval avicularium; occasionally amongst the cells other stouter processes, supporting larger avicularia; spatulate avicularia numerous.

Section β . *Erect, branching.*

6. *C. ramulosa*, Linnæus.

Very common, on Zoophytes from deep water: off Exmouth (fine); Cornwall (30 fathoms), &c.

7. *C. dichotoma*, n. sp. Pl. XII. figs. 7, 8.

Polyzoarium slender, narrowed towards the base, dichotomously branched; branches cylindrical, tapering towards the extremities, pointed; cells ovate, ventricose, smooth; orifice orbicular above, slightly produced below, in front of it a short and tumid rostrum, with a small avicularium on one side of it, near the top; ovicell globose, silvery, covered in front with punctures, the margins of which are raised; occasionally a spatulate avicularium on one side of the orifice; numerous minute subcircular avicularia distributed amongst the cells. The surface of the polyzoary is pierced by circular orifices, which occupy the intercellular spaces.

On Zoophytes from 30 fathoms, off Polperro.
[Ireland.]

Fam. *Escharidæ*.1. *ESCHARA*, Ray.1. *E. foliacea*, Ellis & Solander.

Common in deep water, Devon and Cornwall: off Budleigh-Salterton (very abundant), Exmouth, &c.

2. *E. cervicornis*, Busk, 'Catalogue,' p. 92.

Common on stones from deep water, coast of Cornwall; 'Devonshire' (*Dr. Coldstream*).

Great uncertainty exists as to the synonymy of this species. The form here intended is the *Cellepora cervicornis* of Couch's 'Cornish Fauna,' which would seem to be identical with the *Eschara cervicornis* of the 'British Museum Catalogue,' judging from the *description* in that work. Mr. Busk, however, in a paper on Norwegian Polyzoa (Ann. Nat. Hist. for 1856, vol. xviii. p. 32), expresses an opinion that these are distinct species, identifying Mr. Couch's with a Norwegian form, of which a figure (without description) is given. The figure, which is not from Mr. Busk's hand, is of little value, and does not help towards a settlement of the point. At present I am inclined to regard the *C. cervicornis* of Johnston and Couch and the *E. cervicornis* of the 'Catalogue' as one species. The *Millepora cervicornis* of Ellis and Solander is a perfectly distinct form.

3. *E. Skenei*, Ellis & Solander.

Not common, deep water: Torbay, on shell; off Polperro. "On stones and the *Pinna ingens*, off the Deadman; rare" (*Couch*).

2. *RETEPORA*, Lamarck.*R. Beaniana*, King.

Very rare: on a stone from 40 fathoms, south-west of Polperro. A very fine full-grown specimen of this beautiful Coral, and one or two young ones, were obtained from the above locality.

[Shetland (*Barlee*); off the Land's-End (*Couch*)].

Suborder *Cyclostomata*, Busk.Fam. *Idmoneidæ*, Busk.*PUSTULOPORA*, Blainville.*P. deflexa*, Couch.

Common on stones, shells, &c., from deep water: coast of Cornwall, abundant; dredged close under Berry Head, on weed.

The erect cylindrical stalks are the free extremities of a branched creeping base, which spreads, like an *Alecto*, over the surface of shell or stone. A number of branches radiate from a common stem, along which tubular cells are ranged, and each of these branches terminates in a free portion, somewhat clavate, at times expanding into an enlarged head, from all sides of which long waved tubes project. Mr. Couch has not described the common creeping base. It would pass for an *Alecto*, in the absence of the erect portions.

I feel much doubt whether this form is correctly referred to the genus *Pustulopora*. It is probably the *Tubulipora deflexa* of Couch, the free and erect branches agreeing exactly with his description and figure. But no mention is made by him of a branched creeping stem, nor is there any in the diagnosis of *Pustulopora* as given by De Blainville, Johnston, or Busk. In a beautiful specimen dredged near Berry Head, the free portions are dichotomously branched, the branches terminating in a triplet of clavate expansions. From the nature of the habitat, the creeping stem is in this case very inconspicuous; but on stone there is little variation in the form. The creeping branches which radiate from a common stem are adnate through a great part of their course, and bristle with long tubes, but towards the extremities they become erect, cylindrical, subclavate, and bear the cells on all sides. The surface is punctate. This species has the closest affinity with *Alecto*.

Fam. Tubuliporidæ, Busk.

1. TUBULIPORA, Lamarck.

1. *T. serpens*, Linn.

Very common, on stones, shells, and Zoophytes from deep water: on *Pinna* from 60 fathoms, off the Deadman; on *Gorgonia* (very fine), &c.

Some of the specimens on *Pinna* exhibit a very beautiful mode of growth. They are of radiate form, attached to the shell at the centre only, the bifid branches being free and sub-erect.

2. *T. lobulata*, Hassall.

Occasional, on shell: Torbay.

This is probably a good species, and not, as Dr. Johnston was inclined to consider it, a variety of the preceding.

There are important differences between the two forms, in the character and disposition of the cells as well as in the mode of growth. The cells of *T. lobulata* are short and stout, and project very slightly from the crust. They are horizontal, and are

generally not united, nor do they ever form the deep, somewhat curved, transverse rows which are so characteristic of *T. serpens*. The dividing lines are much less strongly marked than in the latter species, and disappear altogether in the expanded portions which terminate the lobes. The lobes or segments are linear and narrow, and more or less rounded at the extremities. Those of *T. serpens* are usually truncate. The polyzoary is depressed, and of a dull-purplish colour, wanting altogether the bright frosted surface of the other species.

The "flower-like" variety of *T. serpens*, which Mr. Alder identifies with the *T. lobulata* of Hassall (Northumb. Catal. p. 46), may be the radiate form which I have described under the first-named species.

[Isle of Man, very common on old shells.]

3. *T. phalangea*, Couch.

Common on shells and weed in moderate depths: Salcombe Bay (abundant), &c.

Cornwall, "in from 10 to 20 fathoms water, common" (*Couch*).

This fine species exhibits two marked forms. In one, the polyzoary is subcircular or very obscurely lobed; the cells are long, slender, sub-erect, and somewhat flexuous, crowded together, and often disjunct at the upper extremity; the mesial dividing lines are almost obliterated. In the other, the lobes are distinct and pointed; the cells are short, united throughout, of somewhat larger bore than in the preceding, and arranged with extreme regularity on each side of a well-defined line, which runs from the centre to the extremity of each lobe. The spaces between the lobes are filled with cells, sometimes united in pairs, sometimes single. Towards the margin they are horizontal and wholly immersed, the apertures forming a close network. In this beautiful form the polyzoary is much depressed, and the surface flat.

To this species perhaps may be referred a remarkable *Tubulipora* which I have met with in old bivalve shells from Salcombe Bay. It forms large, somewhat circular, lobate masses, about an inch in diameter. The central portion is round, with sometimes as many as ten lobes, which are broad at the base, then gradually narrow for some way, and at the extremity expand into a clavate head. The heads, which vary in size, occasionally coalesce, and in some cases the lobes are united throughout the greater part of their length, and we have a somewhat circular crust with a very irregular and jagged outline. On the central disk and the basal portion of the lobes the cells are arranged as in the normal *T. phalangea*. On the enlarged heads

they are disposed in somewhat radiate fashion. This curious variety, deprived of its terminal expansions, bears a striking resemblance to the *Solaster*. In form and general appearance it is utterly unlike the ordinary *T. phalangea*; and yet, such is the tendency to irregularities of growth and habit in this section of the *Cyclostomata*, that I do not venture to regard it as more than a very singular illustration of this characteristic.

In an early stage, *T. phalangea* exhibits a simple bilobed form, and is often of very delicate texture and of a silvery lustre. In this condition the polyzoarium is stalked, and divided into two rounded lobes, which are bent backwards from the point of division, so as to embrace the stalk, below which they finally coalesce. As growth proceeds, other lobes are developed on the *opposite* side, until the normal figure is completed.

4. *T. flabellaris*, Fabricius.

Rare: in a valve of *Pecten*, from the Brixham trawl-boats; on stone.

One or two specimens only have occurred to me in the West of the species figured by Johnston (pl. 46. figs. 5, 6), and which he identifies with the *Tubipora flabellaris* of Fabricius.

[Near the mouth of the Clyde, on coal.]

5. *T. penicillata*, Johnston.

On the Cornish *Pinnae*, common; on stone from 40 fathoms; in a shell from Torbay.

In this species, the erect portion, which bears the expanded celluliferous head, springs from a creeping *Alecto*-like base, which is thickly set with tubes. This creeping stem is commonly branched, and at the extremity of each branch rises one of the disk-bearing stalks. The lower portion of the stalk frequently bears a number of the tubular cells on one side, which are free, and of considerable length. There is great diversity in the height of the peduncular support and in the size of the terminal disk. Mr. Couch, in his description, takes no notice of the creeping base. Should not the genus *Alecto* be modified so as to include both this species and the *Pustulopora deflexa* of Johnston?

[Lamlash, Arran, on stone.]

2. *ALECTO*, Lamouroux.

A. granulata, Milne-Edwards.

"On stones and shells from deep water, not uncommon; Polperro" (*Couch*).

EXPLANATION OF PLATE XII.

- Fig. 1. *Membranipora discreta*, n. sp.
 Fig. 2. *Lepralia affinis*, n. sp.
 Fig. 3. *Lepralia ochracea*, n. sp.
 Fig. 4. *Lepralia hastata*, n. sp.: 4 a, rostrum, with avicularium.
 Fig. 5. *Lepralia armata*, n. sp.
 Fig. 6. *Cellepora avicularis*, Hincks: 6 a, the præoral rostrum.
 Fig. 7. *Cellepora dichotoma*, n. sp.; nat. size.
 Fig. 8. *Cellepora dichotoma*; portion magnified.
 Fig. 9. *Valkeria tremula*, n. sp.

[To be continued.]

XXXVI.—*Note on the Temperature of the Female Python Sebæ during Incubation.* By P. L. SCLATER, Ph.D., F.R.S.

IN the communication made to the French Académie des Sciences Naturelles, in 1841, by M. Valenciennes, and published in their 'Comptes Rendus' for July of that year (vol. xiii. p. 126), certain results are stated to have been arrived at from careful observations made during the incubation of a female of the Indian Python (*Python bivittatus*), which deposited eggs in the menagerie of the Jardin des Plantes on the 5th of May 1841, and hatched out eight young ones on the 3rd of July following. M. Valenciennes's own words on this subject are as follows:—"Il faut conclure de cette observation que la femelle du *Python bivittatus* couve ses œufs, qu'ils sont cinquante-six jours au moins à éclore, et que pendant ce temps l'animal développe une chaleur propre qui diminue cependant graduellement à mesure que l'on approche du moment de l'éclosion des œufs." From the table of observations which is appended to M. Valenciennes's article, it appears that the heat of the incubating female decreased gradually from 41°·5 Cent. (when she first commenced incubation) to 28° Cent. (when the young Pythons were produced),—the temperature of the chamber in which she was kept varying meanwhile from 17° to 23° Centigrade.

When the female *Python Sebæ* in the Zoological Society's reptile-house deposited eggs on the 13th of January last, and commenced sitting upon them, it became a matter of much interest to ascertain whether M. Valenciennes's views as to the evolution of heat by the incubating Python could be substantiated. The thermometers we first used for these experiments being found imperfect, Messrs. Negretti and Zambra, the well-known instrument-makers, on being applied to, kindly supplied us with others of great nicety, manufactured specially for the purpose.

The following is the result, in a tabular form, of the observations made with these instruments by Mr. A. D. Bartlett, the

Superintendent of the Society's Gardens, Mr. Negretti, Mr. Zambra, and myself, on different occasions.

	Air in den.	Station of Thermometer.	Male.	Female.	Difference.
Feb. 12	58°·6	Surface of body..	70°·2	73°·0	2°·8
		Between the coils	74°·8	81°·6	6°·8
Feb. 23	65°·4	Surface of body..	71°·8	75°·4	3°·6
		Between the coils	74°·0	83°·2	9°·2
March 2	60°·0	Surface of body..	71°·6	84°·0	12°·4
		Between the coils	76°·0	96°·0	20°·0
March 9	61°·0	Surface of body..	72°·8	79°·5	6°·7
		Between the coils		86°·5	
March 16	66°·0	Surface of body..	72°·4	77°·6	5°·2
		Between the coils	77°·6	86°·0	8°·4

The male and female Python being in the same compartment of the reptile-house, and subject to exactly the same external influences, it appears evident that the increase of temperature from 6° to 20°, always observed in the case of the latter, can only be attributed to the process of incubation. But these observations do not confirm M. Valenciennes's views as to the gradual decrease of heat towards the time for the eggs being hatched.

XXXVII.—*Descriptions of some New and Rare Zoophytes found on the Coast of Northumberland.* By JOSHUA ALDER, Esq.

[Plates XIII. XIV. & XV.]

Order HYDROIDA.

Fam. Tubulariadae.

Hydractinia areolata, n. sp. Pl. XIII. figs. 1-4.

Polypary encrusting, consisting of a solid chitinous expansion, from which arise simple linear spines in irregular groups, leaving areolar spaces between them. *Polypes* naked, small, white, columnar, slightly enlarging above, and terminating in a conical mouth, below which is a single circle of from six to ten linear tentacles, appearing of different lengths from their varying contractility. Gonophores (reproductive organs) sessile on the chitinous base, large, globular, or slightly pear-shaped, containing each a single medusoid. Height of polype about $\frac{1}{10}$ inch.

Medusoid with a moderately deep subglobose umbrella, having four golden-yellow radiating canals, at the bulbous bases of which, on the margin of the umbrella, are four rather short tentacles; four shorter ones alternate with them; and intermediate

between these are eight others, almost tubercular. The peduncle is rather long and columnar, with four tufts of thread-cells surrounding the mouth.

A single specimen only of this interesting little *Hydractinia* was obtained, parasitical on a dead shell of *Natica Alderi*, brought in by the fishing-boats at Cullercoats. I have since seen a dead and rather worn specimen, upon *Natica Grænlandica*, among the Zoophytes collected in Shetland by the Rev. A. M. Norman. The species differs from *H. echinata* in its much smaller size, the simple linear form of its spines, their irregular grouping, and more especially in its bearing medusoids; these latter spring from the encrusting base. No capsule could be detected, but this might possibly arise from its great transparency. The medusoids bear a great resemblance to those of *Podocoryne carnea*, Sars, the only difference being in their having eight intermediate tubercular tentacles. In this respect they also differ from the medusoid of a Hydroid polype described by Professor Lovén, and referred by him to *Hydractinia*, but which appears rather to belong to the genus *Podocoryne*, as the base was not horny or spinous. As far as I am aware, therefore, this is the only instance in which medusoids have been ascertained to be produced by a true *Hydractinia*.

Coryne implexa, Alder.

Some confusion has arisen about this species, the polypary of which I described under the name of *Tubularia implexa* in my 'Catalogue of the Zoophytes of Northumberland and Durham,' not having at that time been able to ascertain the character of the polypes, from which alone the genus in this group can be properly determined. Dr. T. Strehill Wright, however, has since met with it in a living state, and has found that it belongs to the genus *Coryne*. The *Coryne* figured in my 'Catalogue' under the provisional name of *Coryne pelagica* (pl. 7. fig. 2) appears, in fact, to be the young of it. I have lately met with it again in this state at Cullercoats, and have ascertained that its medusoid is similar to the one described by Professor Allman as that of his *C. Briareus*, which I now think, with Dr. Wright, must also be referred to the same species. Specimens sent me from the Firth of Forth by the latter gentleman are intermediate in size between my *Tubularia implexa* and *Coryne pelagica*. The more humble growth appears to be not uncommon on our coast, as I have met with it several times on old crusted shells of *Fusus antiquus*, and Mr. G. Hodge has lately sent it me from Seaham Harbour, creeping over *Cellepora pumicosa*. As the curious and beautiful medusoid of this species has not yet been figured, I have given a representation of it in Pl. XIV. fig. 4.

Atractylis arenosa, n. sp. Pl. XIII. figs. 5-7.

Polypary minute, consisting of a creeping fibre, from which arise short funnel-shaped tubes, rather irregular in form, but always expanding more or less at the top, from which the polypes issue; generally covered with minute grains of sand. *Polypes* entirely retractile, with long, slender, strongly muricated tentacles, varying in number, according to age, from six to twelve.

The genus *Atractylis* has been established by Dr. Strethill Wright for a group of Hydroid Zoophytes resembling *Eudendrium* in many of their characters, but differing in the conical form of the mouth of the polype, and its retractility (partial or complete) within the tubular polypary. They are generally of small size, and seldom branched. Their reproduction is usually by medusoids; but Dr. Wright, who has lately met with the present species in the Firth of Forth, has ascertained that it produces planuloid young direct from the summit of the ovarian sac. This affords another proof of the difficulty of establishing a genus from the mode of development.

I have met with this species occasionally, for some years past, on stones and the roots of *Laminariae* at Cullercoats and Tynemouth. From its minute size, it requires to be carefully looked for.

Atractylis linearis, n. sp. Pl. XIV. figs. 1-3.

Polypary linear, horn-coloured, unbranched(?), nearly smooth, a little undulating and slightly wrinkled on the lower part; the stems united together by reticulated creeping tubes at the base. *Polypes* slender, retractile, with eight long muricated tentacles, held alternately up and down. Gonophores pear-shaped or subglobular, set two or three together on the stem of the polypary, each capsule containing a single medusoid. Height a quarter of an inch.

Medusoid globose, slightly truncated below, with a contracted aperture; four moderate-sized subclavate tentacles arise from four semicircular yellowish lobes at the margin of the umbrella: sub-umbrella small, with four radiating canals, the centre occupied by a mass of yellowish or orange granules, apparently ova; peduncle inconspicuous, branched at the base.

On *Turritella communis*, *Astarte Damnonia*, and other shells from deep water, Cullercoats.

This species has considerable resemblance to *A. repens*, Wright, but its polypary rises much higher, is proportionally more slender, and not so much expanded at the aperture. In the young state, however, it is difficult to distinguish them. Their medusoids, nevertheless, are very different, and prove them to be distinct species. I have never met with *A. linearis* branched, though it is possible it may occasionally be so in luxuriant specimens.

Corymorpha nana. Pl. XV. figs. 1-5.*Corymorpha nana*, Alder in Tynes. Club Trans. vol. iii. p. 108.

It is now nearly twenty years since I first met with this interesting little species, at Newbiggin, from which time I had looked for it often without success until the summer of 1860, when I fortunately obtained two living individuals at Cullercoats. This puts me in a position to add considerably to the information hitherto published concerning the species, as well as to give more correct drawings of it in the living state. *Corymorpha nana* is a very active animal, constantly changing its form and the proportions of its parts. Sometimes the head is elongated into a slender tube, sometimes contracted so as to become nearly globular. The tentacles and body are equally subject to dilatation and contraction in their different parts. In many of its states it bears a considerable resemblance to a miniature *Corymorpha nutans*, from which, however, it differs not only in its diminutive size, but in the smaller number of tentacles, and in the gonophores being sessile (not pedunculated or branched as in the latter), and large in proportion to the size of the animal. The medusoid differs from that of *C. nutans* in having the umbrella rounded at the top; in other respects it is very similar. The following detailed description will show the characters of this species more distinctly:—

Head subtubular, yellowish, the mouth conical, surrounded by about sixteen or eighteen short tentacles, forming two imperfect rows. A single circle of fifteen to twenty long filiform tentacles surrounds the base of the head, immediately above which the gonophores form another circle of urn- or bell-shaped bodies, in different stages of development; these are sessile, and in their more advanced state assume the perfect medusoid form, showing lively motions of systole and diastole for some time before becoming free. The body of the polype is elongated, tubular, and tapering to a point at the base; it is soft and flexible, transparent, white or yellowish, with opaque, white lines. It is enclosed in a transparent filmy sheath, ending at the base in a gelatinous mass (colletoderm of Wright?) by which the animal is attached, though slightly, the pointed base of the fleshy body (cœnosarc) being free. Tubercles arise from the lower ends of the opaque white lines, which frequently enlarge into linear processes, whose use is not very apparent. They may possibly form additional organs of attachment, but in the specimens examined their ends were free. Length of the polype $\frac{1}{2}$ to $\frac{5}{8}$ inch.

Medusoid with a rather deep, semiglobose, transparent, white umbrella, having four yellowish radiating canals; three of them ending in a yellow bulb at the margin of the umbrella, the

fourth produced into a club-shaped tentacle, apparently not capable of much extension. The peduncle is rather long and thick, terminating in a plain rounded mouth.

These medusoids were produced from one only of the individuals obtained; the other had gonophores of a different shape, having tuberculated lobes rising somewhat irregularly from the upper part, as represented in fig. 5. These reproductive bodies were also sessile, and remained attached during the whole time that the polype continued to live—about ten days—without showing the least signs of assuming the medusoid form. Indeed their appearance was very different from that of the same organs in the medusa-bearing individual, and I have little doubt of their remaining permanently fixed. This difference in the reproductive organs in different individuals of the same species has not been before observed, as far as I am aware, in this genus. They probably represent a sexual distinction. Professor Sars has met with a *Corymorpha* on the Norwegian coast (*C. glacialis*, Sars), in which the gonophores are persistent, and apparently somewhat similar to the non-medusoid form of this species; but in the Norwegian Zoophyte both sexes were found to have the same character.

Family Sertulariadae.

Halecium filiforme, n. sp.

Polypary very slender, flexible, simple or consisting of a single tube throughout; the stem not much branched; the branchlets short, alternate, arising from the side of a cell; the internodes rather long. Cells rather slender, tubular, with a slightly everted rim. Length $4\frac{1}{2}$ inches.

From the fishing-boats, Cullercoats.

This species is distinguished from all those of a similar size, belonging to the same genus, by having the stem simple and uncompounded throughout its whole length, as well as by its very slender thread-like form and great flexibility; most of the species of this genus becoming rigid when dry. It has occurred to me only once, when I obtained a few specimens together, apparently torn from the same base. The reproductive capsules were absent, but there can be little doubt of its distinctness from any described species.

Family Campanulariadae.

Campanularia raridentata, n. sp. Pl. XIV. f. 5.

Polypary with a creeping stem, from a slight bulbous expansion of which arise at intervals rather short pedicles, ringed above and below, and terminated by a single cell. Cells rather long and narrow, tapering a little below, and with 5 or 6 deep pointed crenulations round the margin. Height $\frac{1}{20}$ inch.

Parasitical on other Zoophytes, from deep water, Cullercoats ; occasionally.

This delicate little *Campanularia* bears great resemblance to *C. Johnstoni*, from which it is distinguished by its much smaller size, by its cell being much narrower, and not having more than half the number of denticles on the margin, and also from the pedicles springing from a bulb at the base. It is sometimes associated with *C. Johnstoni* and other closely allied species, but may generally be detected at once by its greater minuteness and delicacy. Mr. Hincks states that this species is not uncommon on the Devonshire coast.

Order ASTEROIDA.

Family Pennatulidæ.

Virgularia Christii, Koren and Danielssen.

Virgularia Christii, "Kor. and Dan. in Magaz. f. Naturv. (Christiania, 1847);" idem in Fauna Litt. Norv. pt. 2. p. 91, t. xii. f. 7-12; Sars in Fauna Litt. Norv. pt. 2. p. 71.

A notice of the occurrence of this fine species on the Northumberland coast was inserted in the 'Transactions' of the Tyneside Naturalists' Field Club (vol. v. p. 60), and some account of it was then given. As, however, our specimens differ in some respects from the description given by MM. Koren and Danielssen in the 'Fauna Littoralis Norvegiæ,' I have thought it necessary to describe the British form more at length, premising that, as the specimens were obtained from the fishermen in a dried state, the account of them must necessarily be somewhat imperfect.

Polypary about 17 inches long, very slender, linear, with the upper part curved into an arch. The lower and sterile portion of the stem, occupying from a fourth to a fifth of the entire length, is slender and cylindrical above, and scarcely more than a tenth of an inch in diameter (when dry); about three-quarters down, however, it swells abruptly to three times that breadth, and is a little flattened, tapering from thence to an obtuse recurved point. About three-fourths of the upper portion of the polypary is covered with rather small, sessile polype-cells, which are arranged in two very oblique rows in front, sloping upwards towards the centre. At first these rows have a central space between them, but higher up they approach so close as to touch each other. The upper rows contain 5 or 6 cells each, decreasing in number below. The dorsal ridge is bare, but the polype-cells twist once round the axis during their course. The curved portion of the stem does not occupy more than a tenth part of the whole length; and at that part the fleshy base of the cells

extends into a web-like expansion. The cells are conical, terminating in two unequal points above. Their walls contain linear calcareous spicula in bundles converging to these points. The polypes also contain spicula. The osselet or central bony axis, extending the whole length of the polypary, is linear, cylindrical and very slender, but becomes thicker and fusiform towards the base. It terminates above in a fine curved filament.

In the Norwegian specimens the polypary is 26 inches in length, and the curve occupies about one-third of the whole, whereas in British examples the entire length (in the three specimens obtained) is not more than 17 inches, and the curve does not exceed a tenth of the whole length. A more striking peculiarity consists in the web-like expansion of the polypiferous base in the curved portion; but this may possibly be occasioned by the contraction of the fleshy part in drying; and as dead specimens only have been obtained, these small discrepancies cannot be considered sufficient to constitute a specific distinction.

Professor Sars describes a fine *Virgularia*, 40 inches in length, belonging to this section of the genus, in the 'Fauna Littoralis Norvegiæ,' under the name of *V. Finnarchica*. It was obtained by him in Finmark, and approaches very closely in many of its characters to *V. Christii*. These species differ from *Virgularia mirabilis* in containing calcareous spicula.

EXPLANATION OF THE PLATES.

PLATE XIII.

- Fig. 1. Polypary of *Hydractinia areolata* on *Natica Alderi*, natural size.
- Fig. 2. *Hydractinia areolata*, highly magnified.
- Fig. 3. A portion of the polypary of the same, highly magnified.
- Fig. 4. Medusoid of the same, highly magnified.
- Fig. 5. *Atractylis arenosa*, natural size.
- Fig. 6. The same, highly magnified.
- Fig. 7. A tentacle of the same, much enlarged.

PLATE XIV.

- Fig. 1. *Atractylis linearis*, natural size.
- Fig. 2. The same, highly magnified.
- Fig. 3. Medusoid of the same, highly magnified.
- Fig. 4. Medusoid of *Coryne implexa*, highly magnified.
- Fig. 5. *Campanularia raridentata*, highly magnified.

PLATE XV.

- Fig. 1. *Corymorpha nana*, with medusoid gonophores, magnified.
- Fig. 2. Another individual, with persistent (non-medusoid) gonophores, magnified.
- Fig. 3. Medusoid gonophores, more highly magnified.
- Fig. 4. Free medusoids, more highly magnified.
- Fig. 5. Non-medusoid gonophores, more highly magnified.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

November 12, 1861.—Dr. J. E. Gray, V.P., in the Chair.

DESCRIPTION OF A NEW SPECIES OF ELAPOMORPHUS FROM BRAZIL. BY DR. OTHO WUCHERER, CORR. MEMB.

ELAPOMORPHUS SCALARIS.

Eight upper labials, the fourth and fifth touching the eye, the seventh largest. Scales in seventeen rows; 128–130 ventral shields; dirty brick-red above; head brownish, with a black narrow dorsal streak traversed by short black bands; narrow black spots on the sides.

Hab. Cañavieras, Matta de S. João, Bahia.

Description.—The body of moderate length, almost cylindrical; belly flat; the tail short. Head moderate, distinct, with flat crown; the cleft of mouth moderate; rostral shield triangular, almost reaching the surface of the head, recurved, concave, the inferior edge slightly protruding; three frontals, two anterior and one posterior, the former small, almost triangular, very narrow in the antero-posterior direction, the posterior one very large; one nasal pierced by the nostril; nostril large, lateral; superciliary shield small; one anterior, two posterior oculars, the anterior large, high, forming a short suture with the vertical; loreal elongate; vertical moderate, almost triangular; occipitals large, forked behind; one temporal, sometimes two, one behind the other, touching the inferior posterior ocular; upper labial shields eight, the fourth and fifth touching the eye, the seventh largest; eye moderate, sublateral, pupil round; scales rhombic, not truncated, smooth, equal, without any groove, a few in the middle row of the tail larger, in seventeen rows; posterior tooth longest, grooved; two pair of chin-shields. Snout and part of crown brown and bluish iridescent, irregularly speckled with black; lips white; the back is of a dirty brick-colour: a black streak, of the breadth of the middle dorsal row of scales, runs along the body almost to the tip of the tail; this is crossed by short, transverse, black bands, some of which do not correspond exactly in their lateral halves; on the sides a line of narrow, almost linear, black spots; underneath uniform yellowish white.

Dimensions of two specimens:—

Length of head	0·010	0·013
Length of tail	0·040	0·055
Total length	0·320	0·250
Ventral shields	128	34
Subcaudal shields	130	34

The smaller specimen is in the British Museum. The larger specimen was sent to me from Cañavieras. It was injured in the head, and a few characters are not recognizable; the smaller corresponds with it in every particular. I received it from M. C. Gayleard, from the Matta de S. João, a few leagues south from the city of Bahia.

This species differs from others in the shape of its head, which is distinct, in having a shorter body, broader ventral shields, and seventeen rows of scales; but the dentition and coloration are very similar.

NOTICE OF A NEW SPECIES OF PILOT-WHALE (*GLOBIOCEPHALUS*), FROM THE COAST OF DORSETSHIRE. BY DR. J. E. GRAY, F.R.S., V.P.Z.S., ETC.

In 1853 the British Museum received the skull of a Cetacean which was dredged up at Bridport, on the coast of Dorsetshire, from the Rev. John Beecham, of the Wesleyan Mission Board. It is evidently a species of *Globiocephalus*; but on comparing it with the skull of *G. Svineval*, the Common Pilot-Whale, and other species of *Globiocephalus* which have come under my observation, it appears to be quite distinct from them, and, as I believe, of a species that has not before been noticed.

It is evidently the skull of a large animal, being nearly as large as that of the Common Pilot-Whale; but it is at once distinguished from all the other species of that genus by the convexity of the palate and the oblong form of the nose of the skull, which is nearly of the same width for the greater part of the length, and is regularly rounded in front; while in *G. Svineval* it gradually converges from the notch to the apex, and the palate is quite flat, especially in front; and this is the case with all the other species of the genus.

GLOBIOCEPHALUS INCRASSATUS. Thick-palated Pilot-Whale.

Teeth $\frac{9-9}{0}$ or $\frac{10-10}{0}$; the nose of the skull attenuated, the sides nearly parallel, and regularly rounded in front; the palate very convex, especially in the front; the upper surface of the intermaxillaries rugose in front.

Hab. British Seas, Bridport (*Rev. J. Beecham*, 1853).

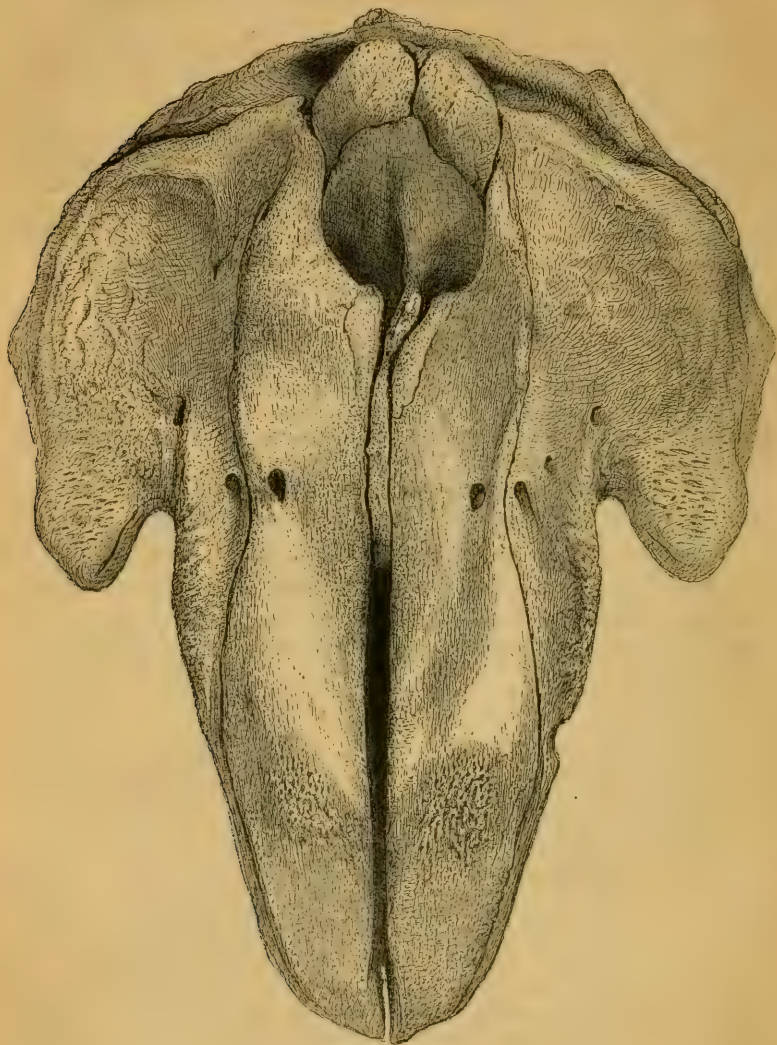
	inches.
Length of the skull.	28
—— of the nose.	14
—— of the teeth	8? imperfect, worn at the end.
Width of nose at the bridge	10
—— of nose at the under .	$9\frac{1}{2}$
—— of skull at orbits. . . .	17

The back of the skull is higher and much narrower than in the skull of *G. Svineval*. (See woodcuts, pp. 320, 321.)

This species does not appear to have been observed before as British, and I do not find any indication of its having been described as an exotic species. But it is so distinct both in the form of the nose of the skull, in the width of the intermaxillary bones, and more especially in the thickness and convexity of the palate of the front part of the skull, from the species that has hitherto been described, and the differences are so visible, that Mr. Edward Gerrard selected it as a distinct species as soon as he saw it.

It has been suggested that this may perhaps be the other sex of the common Pilot-Whale (*Globiocephalus Svineval*); but I can

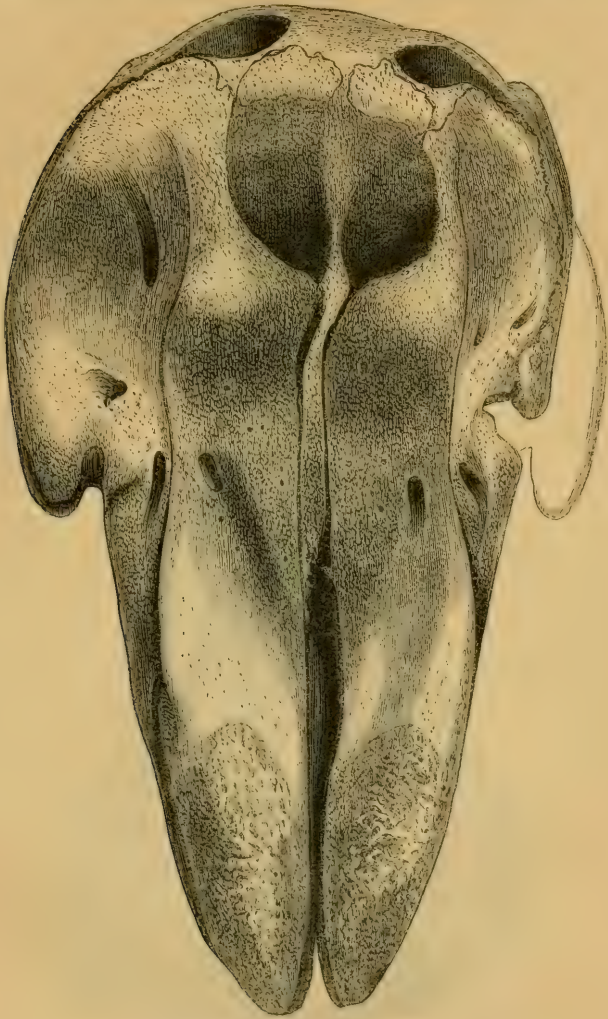
scarcely think this probable, as I have seen many skulls of the latter, and they have been all nearly similar and very unlike the one under



Upper surface of the skull of *Globiocephalus Svineval*.

consideration; and I can scarcely believe that all I have seen could have been of the same sex, for it is a Whale that comes on the coast in great shoals, and hence one of its names is the "Social Whale," and

specimens of both sexes have been recorded as caught on the British coast. At the present moment there is an inclination to regard some of the Whales which have been considered species as mere sexes of



Upper surface of the skull of *Globiocephalus incrassatus*.

the same species, simply because the specimen described in one case happens to be a male and in the other a female. Thus *Delphinus micropterus* is said to be the female of *Ziphius Sowerbiensis*, for the

above reason ; but I have not heard that any new specimen has been discovered, or any fact eliminated, to prove the truth of this suggestion, and it may be only an instance of accidental coincidence—

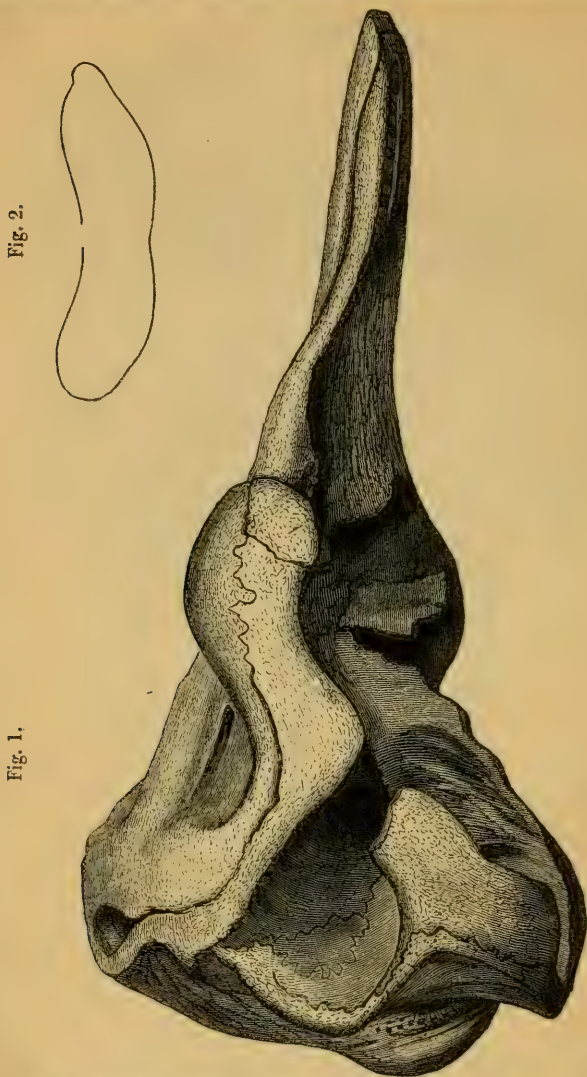


Fig. 2.

Fig. 1.

Fig. 1. Side view of skull of *Globiocephalus incrassatus*.

Fig. 2. Diagram of the cross-section of the palate of *G. incrassatus*.

such a case as may be disproved by the next discovery of either animal.

In the same manner Professor Eschricht, of Copenhagen (and no one has studied the Whales of the North Sea with greater earnestness and success), regards *Hyperoodon latifrons* as the male of the old well-known *Hyperoodon rostratum*, because his example of the former belongs to a male, and that of the latter to a female specimen; and he exhibits them side by side as sexes of the same animal in his Museum (see Ann. and Mag. Nat. Hist. 1852, ix. p. 281). Now this is an evident mistake, arising from mistaking an accidental coincidence for an established fact.

The specimen from which the skeleton of *Hyperoodon latifrons* was derived, that is in the Museum of the College of Surgeons in Edinburgh, was a *female*, which was taken on the 24th of October, 1839, accompanied by a young male, in the Frith of Forth. Therefore there are female as well as male specimens known of *Hyperoodon latifrons*, which is regarded by Professor Eschricht as the male of the more common *H. rostratum*, of which I have also seen males as well as females, as recorded in my paper on this subject in the 'Proceedings' of the Society for November 1860.

ON A LARGE SPECIES OF TEREDO, SUPPOSED TO BE THE
ANIMAL OF THE GENUS FURCELLA, LAMK. BY DR. J. E.
GRAY, F.R.S., V.P.Z.S., F.L.S., ETC.

In a former communication to the Society on the genus *Furcella*, I came to the conclusion that the animal of that genus was destitute of any shelly valves, because on examining the tube of a young specimen in a very perfect state, containing in its cavity the two palettes of the animal, it had no appearance of valves, which I supposed would be of too large a size to have escaped out of the tube, more especially as the palettes were in it, which were of a much smaller size and more slender character than the valves were likely to be, and the tube had all the appearance of the animal which formed it having been eaten out by the larvæ of *Muscidæ*, as the skins of the larvæ and pupa-cases were found in the tube with the palettes.

But this shows the danger of coming to any conclusion without having the actual specimen before one; for we have lately received from Mr. Jamrach, along with a number of Fishes, Reptiles, and other animals in spirits, chiefly from the Dutch Colonies of the Indian Ocean, two specimens of a large species of true typical *Teredines* in spirit, without their shelly tube, but with their palettes attached, which seem to be very probably the animal of the genus *Furcella*.

The reason why I believe them to be the animal of that genus is, first, their large size, which is quite sufficient to form a tube as large as the younger specimen of the genus *Furcella*, and, secondly, the form and size of the palettes, which agree in general character with those which were found in the tube of *Furcella*, and which are figured in the 'Proceedings' of the Society for 1857, p. 243, Mollusca, pl. xxxix. f. 3. Yet there is just that amount of difference

between the palettes of these animals and those found in the young specimen of *Furcella* which prevents one from saying that the animal is absolutely the animal of the *Furcella*.

The palettes of *Furcella* were slender, cylindrical, with a dilated tip like a double-headed hammer, like the young palette of *Teredo malleolum* of Turton, but of a much larger size; and they had a small, slightly-raised tubercle on the middle of the inner side of the dilated end.

The palette in the two specimens of *Teredo* which we have lately received is of precisely the same form, and nearly of the same size; but instead of having this small tubercle, the middle of the dilated end is produced into an elongated process about half an inch long, which is more slender and oblong at the base, thicker, flattened, and dilated above, and truncated at the top.

The valves of the shell are exactly like those of the *Teredo navalis*, *T. norvegicus*, and other normal species of the genus, but larger.

I am inclined to name this species *Teredo furcelloides*; for I do not think it would be safe to decide, without further evidence, that it is the animal of *Furcella*, Lamk.; but at the same time I consider it right to bring the occurrence of this animal at once before the Society, as it has led me to doubt if my conclusion was correct that *Furcella* is a genus of Conchiferous Mollusks without any valves, as I was inclined to believe before the animal occurred, and which the evidence then before me led me to believe was a correct conclusion.

The palettes are situated at the hinder end, just within the edge of the mantle, the siphons being quite distinct from or within their base. The siphons are slender, of nearly equal diameter, and united nearly to their tips; in their contracted state they just reach to the dilated part of the palette at the base of the terminal elongated process. There are some fragments of a thin lamina of shell attached to the hinder end of the mantle near the base of the palettes.

If this should prove to be the animal of *Furcella*, or even of a *Furcella*-like *Teredo*, it shows most conclusively that the cup at the end of the tubes cannot be regarded as the analogue of the true valves of the genus, as I have also proved in a former paper (see Proc. Zool. Soc. 1858, p. 258).

If these animals prove to belong to the genus *Furcella*, as I suspect they may, then that genus or group of species will only be separated from the other *Teredines* by the habit of living in sand, by the club-shaped form of the tube closed at the end with two arched plates, the division and separate prolongation of the tubes of the siphonal aperture, and the hammer-like form of the palettes.

Nov. 26, 1861.—Dr. J. E. Gray, V.P., in the Chair.

NOTES ON THE BREEDING AND REARING OF THE CHINESE CRANE (*GRUS MONTIGNESIA*) IN THE SOCIETY'S GARDENS.
By A. D. BARTLETT.

Near the middle of May a pair of these birds formed a rude nest of dry rushes on the ground; and soon afterwards two eggs were laid. The parent birds took turns upon these eggs during the time of in-

incubation. On the 24th of June a young Crane was hatched, the period of incubation having been thirty days.

The young bird was well covered with down of a light-brown or fawn colour, with darker markings on the back ; it was short on its legs, and the bill also appeared short ; in fact, it appeared less like a Crane than I expected to see it. It was able to walk about as soon as it was hatched, but appeared feeble, and now and then fell or rolled over in its attempts to follow its parents.

The old birds attended to the young one with much care, and furiously attacked everything that came near the place ; they collected worms and beetles, &c., from all parts of their enclosure, which they brought in their bills towards the young bird, and after mutilating all living food, they would hold it near the young bird, who would advance and pick it from their bills, or from the ground as soon as it was dropped by them. The young Crane never opens its mouth and cries for food like the Storks or Herons and many other young birds, but utters a rather loud note, like *peep, peep, peep*, not unlike the chick of a common fowl ; it is not, however, as adroit and able to obtain its food as the young of the Gallinaceous birds generally are ; and consequently the parent birds are far more attentive, and watch every opportunity of obtaining food and preparing it for the young one. I have frequently seen the old birds offer a piece of biscuit (that the young bird found was too large to swallow), and they then would place it upon the ground, and by repeated blows break it up in small pieces, and then drop these close to the young bird, who would pick them up and swallow them. From these observations I am induced to consider that the Cranes (*Grus*) occupy an intermediate position between those birds that feed their young like the Herons and Storks, and those groups, like the Bustards and Plovers, whose young are at once able to run about and seek their food.

Perhaps the most remarkable thing is the rapid growth of the young Crane, which is very surprising. As I have before stated, at first the legs are short ; in fact, as compared with the parents, the bird is remarkably small, and few persons would guess what it possibly could be ; in a few days, however, the legs begin to grow rapidly, and the neck and bill become elongated, and the bird quickly appears a Crane in shape.

From the time of hatching, the female alone broods upon or nestles the bird, although the male takes turn in the task of incubation ; and I notice the female does not squat down on the young one to brood, but sits down on the ground near it, and the young bird immediately walks behind her ; she then raises her long black plumes, between which he creeps, and passes forward under one of her wings, until quite out of sight ; her plumes are then lowered into their ordinary position.

There is a beautiful example of the progressive growth from the first down to the perfect feathers to be seen on the young of this bird. I have in many birds observed this, but not to so great an extent. It appears that the first down is not thrown off, but continues to grow longer, until the perfect feather is developed having the early down

attached at its point: this condition is to be seen not only on the points of the primaries, but also on the ends of the feathers of the entire plumage. Thus the bird for some time carries his early dress on the outside of his second plumage. The rapid growth of the plumage can be best understood from the fact that on the 27th of September it was found necessary to catch the young bird in order to cut the primaries of one of its wings (which I exhibit), to prevent its flying away. The bird by this time almost equalled its parents in size, and is now assuming the colour of the adult.

ON A COLLECTION OF FISHES SENT BY CAPT. DOW FROM THE
PACIFIC COAST OF CENTRAL AMERICA. BY DR. ALBERT
GÜNTHER.

A small collection of Fishes transmitted to the Society by its Corresponding Member, Capt. Dow, from the Pacific coast of Central America, has proved to be one of great interest, not only because it contains an unusually large proportion of new species, but also because it illustrates a very strange fact with regard to the geographical distribution of the class of Fishes. Several instances of one and the same species occurring on both the Atlantic and Pacific sides of Central America have been known to me for several years. Nevertheless when Mr. Fraser sent home his last collection, made on the Pacific side of the isthmus, and when I found several West Indian species of fishes in it, I was much surprised, and rather inclined to assume that accidentally some confusion had taken place. Every doubt, however, is removed by this last arrival, of Capt. Dow's collection, containing five species out of fourteen which are identical with Atlantic forms, namely:—*Batrachus surinamensis*, *Salarias atlanticus*, *Clinus Delalandii*, *Mugil proboscideus*, and *Fistularia tabaccaria*. It is, however, worthy of remark, that nearly all the species belong to genera living near the coast, and freely entering fresh waters.

The ichthyic fauna of the western coasts of America, between 8° north and 8° south of the Tropic of Cancer, offers a remarkable assemblage of types which belong to very different geographical regions,—representatives of the faunas of North-west America, of the Pacific coasts of South America, of Japan, and of the Sandwich Islands, and of the Atlantic being mixed with a great number of forms peculiar to the area mentioned.

We give, first, a list of the species contained in Capt. Dow's collection:—

1. *Apogon Dovii*, n. sp.
2. *Gobius paradoxus*, n. sp.
3. — *seminudus*, n. sp.
4. *Euctenogobius sagittula*, n. sp.
5. *Batrachus surinamensis*, Bl. Schn.
6. *Blennius brevipinnis*, n. sp.
7. *Salarias atlanticus*, C. & V. var. (see Gthr. Acanth. iii. p. 243).
8. *Clinus Delalandii*, C. & V.

9. — *macrocephalus*, n. sp.
10. *Auchenopterus monophthalmus*, n. sp.
11. *Mugil proboscideus*, n. sp.
12. *Myxus harengus*, n. sp.
13. *Fistularia tabaccaria*, L.

14. *Halichæres*, sp.—The species appears to be new; but the single specimen sent is in too bad a condition to admit of a description.

With the exception of the first species, the others are included in my 'Catalogue of Acanthopterygian Fishes,' vol. iii., for which the following accounts have been prepared.

APOGON DOVII.

D. 6 | $\frac{1}{9}$. A. $\frac{2}{8}$. L. lat. 25. L. transv. $\frac{3}{9}$.

A roundish black spot on each side of the root of the caudal; the spinous dorsal colourless, transparent; uniform olive (in spirits). Head densely punctulated with brown. Only the hind margin of the posterior præopercular ridge is serrated. Dorsal fins nearly equal in height.

The height of the body is one-third of the total length (without caudal), the length of the head two-fifths; eye large, its diameter being more than one-third of the length of the head. Palatine and vomerine teeth present. The upper jaw overlaps slightly the lower; maxillary extending backwards to below the posterior third of the orbit. Operculum with an upper flexible point, and with a lower stiff spine. The third dorsal spine is a little longer than the second, one-half of the length of the head. Caudal fin slightly emarginate, with the angles rounded.

Total length 26 lines.

This species is so closely allied to *A. inermis*, from the Mediterranean, that perhaps it would be better not to separate it; the only difference which we can find is the form of the soft dorsal fin, which is considerably higher than the spinous in the Mediterranean species.

GوبيUS PARADOXUS.

D. 6 | 11. A. 9. L. lat. 14.

The head and the trunk are entirely naked to between the second dorsal and the anal, the remainder is covered by ctenoid scales of moderate size; there are nine or ten of them in one of the anterior transverse series. The height of the body is contained five times and two-thirds in the total length, the length of the head four times and a quarter. Head nearly as broad as high, its width being rather more than one-half of its length. Eyes rather close together, of moderate size. Snout obtuse, rounded, as long as the eye; cleft of the mouth slightly oblique, with the jaws equal in length, and with the maxillary extending to below the middle of the eye. Teeth in villiform bands; there are two curved canine teeth on each side of the lower jaw. The first dorsal spine is elongate, filiform, sometimes extending to the base of the caudal; caudal rounded, shorter than the head; none of the pectoral rays silk-like; the ventral terminates at a great

distance from the vent. Blackish (in spirits), caudal and ventral fins black; the dorsal filament whitish.

Gobius seminudus.

D. 6 | 15. A. 10.

Head and anterior portion of the trunk naked; sides with exceedingly small scales, becoming somewhat larger posteriorly. The height of the body is one-sixth of the total length, the length of the head one-fourth. Head with the cheeks swollen, depressed, broader than high, its width being two-thirds of its length. Eyes close together, directed upwards, of moderate size; snout obtuse, as long as the eye; cleft of the mouth slightly oblique, with the jaws equal anteriorly, and with the maxillary extending to below the middle of the eye. Teeth in villiform bands, the anterior of the lower jaw slightly enlarged; there are two small curved canine teeth on each side of the lower jaw. Dorsal fins rather low, the hind part of the spinous dorsal being scarcely lower than the anterior; caudal rounded, as long as the pectoral; none of the pectoral rays silk-like; ventral rather short, terminating at a great distance from the vent. Blackish, fins and sides of the head dotted with black; ventrals black.

The largest of the specimens examined is two inches long. The species has such peculiar characters that it will be readily recognized. It has no natural affinity to the other small-scaled Gobies, which generally have an elongate form.

Euctenogobius sagittula.

D. 6 | 13. A. 14. L. lat. 58.

Twenty longitudinal series of scales between the dorsal fin and the anus, twelve between the anterior portion of the second dorsal and the anal. The height of the body is one-eighth of the total length, the length of the head five times and two-thirds. The head is as high as broad, its width being somewhat more than one-half of its length. Eyes very close together. Snout obtuse, shorter than the eye, the diameter of which is one-fourth of the length of the head. Cleft of the mouth slightly oblique, with the jaws equal anteriorly, and with the maxillary not extending to below the centre of the eye. Head naked; scales on the nape and behind the axil very small, becoming larger posteriorly. The second dorsal spine is the longest, somewhat lower than the body underneath, but higher than the soft dorsal; caudal rather elongate and pointed, two-ninths of the total length. Pectoral shorter than the head; the ventral terminates at a great distance from the vent. Light greenish olive with a series of four brown spots along the middle of the tail; sides of the head with some irregular blackish-violet blotches; dorsal, caudal, and pectoral fins dotted with black, ventral and anal immaculate.

This species has a second series of very small teeth within the maxillary front series; these internal teeth do not appear to be fully developed, but destined to replace those in function. The teeth of the lower jaw form a very narrow band anteriorly, and stand in a single series posteriorly.

BLENNIUS BREVIPINNIS.D. $\frac{11}{12}$. A. 15-16.

The height of the body is nearly equal to the length of the head, and contained four times and a half in the total. The snout is obtuse, with the upper profile very oblique. Jaws without a curved tooth. Orbital tentacle slender, fringed at the base. The dorsal fin commences in the vertical from the operculum, is deeply notched, and not continuous with the caudal. The pectoral is longer than the ventral, and extends on to the vent. Greyish-brown (in spirits), with a darker lateral band.

Total length	lines. 18 or 23
Height of the body	4 or 5

CLINUS MACROCEPHALUS.D. $\frac{22}{12}$. A. $\frac{2}{24}$. C. 13. P. 13. V. $1\frac{1}{3}$.

The height of the body is contained seven times and a half in the total length, the length of the head five times. The head is depressed, rather short, nearly as broad as long; crown of the head broad and flat; interorbital space concave, narrower than the orbit. Snout very short, obtuse, rounded; the maxillary does not extend to behind the posterior margin of the orbit; lips thick. The teeth in the jaws form a band with an outer series of stronger ones; vomerine teeth in a narrow band; palatine teeth none. No orbital tentacles; those at the nostril and on the neck very small. Gill-openings wide, the gill-membranes being united at the throat. Head naked; scales on the body not very small, cycloid. The dorsal fin commences at the occiput, and terminates near the base of the caudal: the spines are flexible, and much lower than the soft rays; the three anterior ones are rather more remote from one another than the following: none of the rays of this or of the other fins are branched. Caudal rounded. The anal is higher posteriorly than anteriorly, about as high as the spinous dorsal. Pectoral rounded, with the middle rays longest, shorter than the head. Ventrals jugular, half as long as the pectoral, with the spine and the outer ray enveloped in a common thick membrane. Dark greyish olive; head and fins blackish; head, base of the pectoral, anterior part of the body, and dorsal dotted with white.

Total length	lines. 61
Height of the body	8
Length of the head	12
Greatest width of the head	11
Depth of the head	$7\frac{1}{2}$
Length of the caudal fin	10
—— of the pectoral fin	$10\frac{1}{2}$

CREMNOBATES (BLENNIIDÆ).

(Substituted for *Auchenopterus*, which is preoccupied.)

Body moderately elongate, with the scales small or of moderate

size. Snout rather short, with the cleft of the mouth of moderate width. A band of small teeth in the jaws; teeth on the vomer. Two separate dorsals, composed of spines only; the anterior short, formed by three spines. Ventrals jugular, composed of three rays. Head with tentacles; gill-opening wide.

CREMNOBATES MONOPHTHALMUS.

D. 3 | 27. A. $\frac{2}{19}$. V. 3. L. lat. 38.

A fimbriated superciliary tentacle; a small one at the nostril and on each side of the nape, both multifid. A black ocellus, edged with white, on the posterior quarter of the dorsal fin.

Description.—This fish is very similar to *Cristiceps argentatus* in general habit, but may be readily distinguished by the dorsal fin, which is entirely composed of spines. Head and body are oblong and compressed; the length of the former is one-fourth of the total, the height of the latter one-sixth. The cleft of the mouth is of moderate width, with the lower jaw slightly prominent, and with the maxillary extending beyond the vertical from the centre of the orbit. The teeth in the outer series are stronger than those in the narrow band behind; vomerine teeth apparently in a single series; palatine teeth none. The orbital tentacle is shorter than the eye, with three or four cilia; the nasal and nuchal tentacles are still shorter. The pectoral is nearly as long as the head, rounded, with the middle rays longest; ventral slender, somewhat shorter than the pectoral, with the outer ray longest. The first dorsal fin commences in the vertical from the præopercular margin; the two anterior spines are a little higher than the second dorsal, and flexible; the membrane behind the third spine extends backwards to the base of the second fin. All the spines of the second fin are stiff and pungent, of nearly equal length, the anterior ones being a little shorter; the membrane of the last spine terminates immediately before the base of the caudal, leaving that fin quite free. Caudal rounded, one-seventh of the total length. The anal commences below the seventh spine of the posterior dorsal, and terminates before the caudal; it has two spines anteriorly. The scales are of moderate size; the lateral line runs closely along the dorsal profile, is bent downwards behind the pectoral, and proceeds along the middle of the tail to the caudal.

Brownish, irregularly marbled with darker; anterior dorsal blackish; a black ocellus, edged with white, on the nineteenth and twentieth spines of the posterior dorsal.

Total length 2 inches.

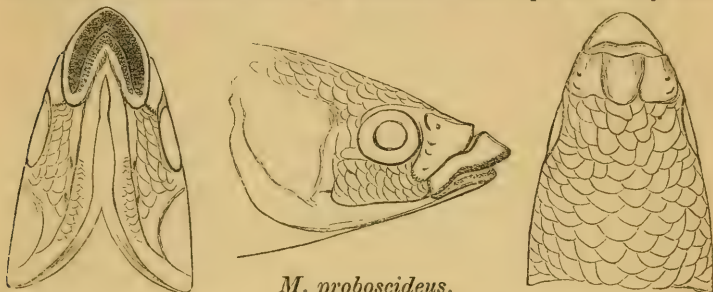
MUGIL PROBOSCIDEUS.

D. 4 | $\frac{1}{8}$. A. $\frac{3}{10}$. L. lat. 38. L. transv. 14.

The front part of the upper lip is extremely thick, conically produced; the lower parts of both lips with a band of soft pavement-like papillæ, arranged in oblique series. Cleft of the mouth deeper than broad.

Description.—This species is naturally more closely allied to *Agonostoma plicatile* than to *Mugil*, but differs from it in having no

teeth at all in the jaws, except that in one specimen the band of papillæ passes into a series of fine moveable teeth anteriorly in the upper jaw. The head and especially the body and tail are compressed; the greatest depth of the body nearly equals the length of the head, and is contained four times and a half in the total length. The upper anterior profile is nearly straight, obliquely descending. The interorbital space is convex, one-half of the length of the head, and scaly, whilst the parts before the orbits are naked. The anterior portion of the upper lip is extremely thick, conically protruding, and nearly as long as the remainder of the snout. A narrow band of soft papillæ occupies the lower parts of the lips anteriorly and



M. proboscideus.

laterally; the papillæ are arranged in oblique series, having a pavement-like appearance. The lower jaws are rather narrow, and the cleft of the mouth is much longer than broad. The maxillary is entirely hidden by the præorbital, which has the extremity truncated and minutely serrated. The eye is much shorter than the snout, and in the present specimen, which apparently is a young one, one-fourth of the length of the head. There are twenty-three scales between the snout and the spinous dorsal fin. The latter commences somewhat nearer to the base of the caudal than to the end of the snout: the soft dorsal and the anal have series of small scales between the rays; the former is higher than the spinous dorsal, and commences above the middle of the anal fin. Caudal emarginate; the anal is rather higher than long, as high as the soft dorsal. The pectoral is inserted above the middle of the depth of the body, and its length is four-fifths of that of the head.

Silvery, upper parts greenish; dark stripes along the series of scales.

MYXUS HARENGUS.

D. $4 \frac{1}{8}$. A. $\frac{3}{10}$. L. lat. 38.

A single series of small fixed teeth in the upper jaw, none in the lower or on the vomer; lips thin. Præorbital serrated anteriorly and inferiorly. Anterior dorsal spines of moderate length, half as long as the head.

Head and body are compressed, the greatest depth being about one-fifth of the total. The cleft of the mouth is rather broader than deep, and does not extend to the anterior margin of the orbit. Sides and belly bright silvery; back green.

ROYAL SOCIETY.

February 20, 1862.—Major-General Sabine, President, in the Chair.

“On the Dicynodont Reptilia, with a Description of some Fossil Remains brought by H.R.H. Prince Alfred from South Africa in November 1860.” By Professor R. Owen, F.R.S. &c.

In this paper the author describes some fossil remains obtained, at the suggestion of H.R.H. the late Prince Consort, by H.R.H. Prince Alfred, during his journey in South Africa. They are referable to two genera of Dicynodont Reptilia. The first specimen is an unusually perfect specimen of the skull, retaining the lower jaw in connexion with the tympanic pedicles, of a species of *Ptychognathus*, showing distinctive characters from previously described species, and which the author dedicates to its discoverer under the name of *Ptychognathus Alfredi*. The anatomical characters of this fossil were described in detail. It was obtained from a greenish sandstone, probably Triassic, of the Rhenosterberg, South Africa.

The second specimen is the skull, with the lower jaw, also *in situ*, of a true *Dicynodon*, referable by its size to the largest known species (*Dicynodon tigriceps*, Ow.). The right maxillary and zygomatic arch having been partially removed in quarrying the rock containing the fossil, a further detachment of the matrix brought into view the descending cranial plate of the frontal, the inter-orbital septum, the upper surface of part of the bony palate with the pterygoid, and the rhinencephalic continuation of the cranial cavity. The presphenoid projects forward as a compressed plate, exceeding in relative length and extent of ossification that in Chelonia, and more resembling that in Crocodilia. Anterior to the presphenoid is the vomer, which expands laterally to join the palatines and pterygoids. Other cranial characters deducible from the present and not shown in previous specimens are noticed. As a whole, the skull exemplifies the near equality in size of this extinct two-tusked reptile of South Africa with the existing Walrus; and it shows that in the structure of the bony palate, as in some other parts of the skull, the *Dicynodon* combines Crocodilian with Chelonian and Lacertian characters.

The specimen above described was obtained by H.R.H. Prince Alfred, from the Karoo beds, in the district of Graaf Reinet, South Africa.

The author next proceeds to describe the pelvis of a *Dicynodon* equalling in bulk the *D. tigriceps*, and most probably belonging to that species. It includes, with five sacral vertebræ, the last of those of the trunk which supported free ribs, showing that there are no vertebræ having the character of lumbar ones in *Dicynodon*. The length of the six successive centrums was 1 foot 2 inches. The ribs of the first sacral vertebra resemble in size and shape the human scapula, but are much thicker; their expanded terminations, 6 inches in breadth, underlap or pass anterior to the iliac bones, to which this rib has been attached by syndesmosis. The ribs of the succeeding

sacral vertebræ are shorter and thicker, and abut against the ossa innominata, as far back as the ischial tuberosities. The ilium, ischium, and pubis have coalesced to form one bone, as in some lizards and in mammalia; and, as in the latter class, the symphysis at which the ischio-pubic portion of each os innominatum joins its fellow is continuous; the pubic symphysis is not separated from the ischial symphysis. But ossification has advanced further than in any mammal, to the complete obliteration of the obturator foramina, which in most reptiles are represented by very wide vacuities. The pubic bones show an oblique perforation near the acetabulum, homologous with that which co-exists with large obturator openings in most lizards. The brim of this singularly massive pelvis measures 10 inches in antero-posterior, and 11 inches in transverse diameter: the outlet measures 4 inches in antero-posterior, and 9 inches in transverse diameter.

In the comparison of this, at present, unique type of pelvic structure, it is interesting to observe, in connexion with the mammalian tusks in the skull, a mammalian condition of the symphysis pubis, and also a mammalian expansion of the iliac bone. In the number of sacral vertebræ *Dicynodon* resembles the Dinosaurian reptiles, as well as some mammalia; and hence it may be inferred that, like the *Megalosaurus* and *Iguanodon*, a heavy trunk was in part supported on a pair of large hind limbs, the weight thereupon being transferred by a larger proportion of the vertebral column than in the prone crawling crocodiles and lizards of the present day.

The author, from certain associated fossils, deduces a probability of the triassic age of the sandstones including the above-described South African Reptilia, and remarks that it is in a sandstone of triassic age in Shropshire where fossil remains occur of a reptile which, in biting with trenchant edentulous jaws, also pierced its prey by a pair of produced weapons analogous to the tusks of *Dicynodon*. Of this reptile, the *Rhynchosaurus articeps*, Ow., the author describes the skull, vertebræ, and some other bones, which have been lately discovered in the New Red Sandstone of Grinsill, Shrewsbury. The remains of the limb-bones in this specimen bespeak a reptile capable of progression on dry land, as well as of swimming in the sea—of one that might leave impressions of its foot-prints on a tidal shore.

ROYAL INSTITUTION OF GREAT BRITAIN.

Friday, March 7, 1862.

“On the Distribution of Northern Plants.” By Professor D. Oliver, of University College, London.

The discourse referred primarily to the botanical evidence bearing upon the hypothesis advanced by Professors Unger* and Heer† of an Atlantic communication between Europe and America at some period of the tertiary epoch. The close analogy which is to be traced between the miocene flora of Central Europe and the existing flora of

* ‘Die versunkene Insel Atlantis.’

† ‘Flora Tertiaria Helvetiæ.’

the Eastern American States, these authors conceive can only be explained by assuming such direct overland connexion of the two continents.

The speaker explained the basis upon which comparisons between two recent floras and between a recent and fossil flora should rest, referring to the peculiar conditions which affect the latter comparison owing to the imperfect and partial character of the fossil element. The general character of the tertiary flora of Central Europe was described. In the tertiary beds of Switzerland, according to Professor Heer*, about 800 species of Phanerogamia have been discovered, referable to 197 genera (exclusive of *Phyllites*, *Carpolithes*, &c.), of which number 145 still exist. Of these genera—

76 are common to the Swiss tertiary,					
and to the present flora of .					
					Europe.
77	.	.	.	.	Japan.
88	.	.	.	.	United States, America.
120	.	.	.	.	Europe and Asia
					(taken together, and
					including Japan).

It is to be noted that the 77 of Japan include 26 not occurring in Europe: amongst them several forms highly characteristic of the tertiary, as *Glyptostrobus*, numerous *Fici*, coriaceous-leaved oaks and *Lauraceæ*, *Juglandææ*, *Liquidambar*, &c.

The genera common to the Swiss tertiary and the United States, which are not found also in the old world, are *Sabal*, *Taxodium*, *Bumelia*, *Liriodendron*, *Ceanothus*, *Ptelea*, and *Carya*. But in respect to these 7 it was observed that at least 5 were very doubtful determinations. The 9 largest orders of the 'Flora Tertiaria Helvetiæ' are *Leguminosæ*, *Amentaceæ*, *Cyperaceæ*, *Proteaceæ*, *Lauraceæ*, *Gramineæ*, *Coniferæ*, *Compositæ*, and *Aceraceæ*. Of these Orders 3 are included in the 9 largest of Europe, 4 in the 9 largest of the United States, and 6 in the 9 largest of Japan, while the remaining 3 of the tertiary, not included in the 9 largest orders of Japan, are much more largely developed in Japan than in the United States. They are *Lauraceæ*, *Aceraceæ*, and *Proteaceæ*.

The proportion of ligneous to herbaceous species in the above floras was alluded to. Heer estimates ligneous plants to have formed about 66 per cent. of the phanerogamic vegetation of the tertiary in Switzerland. The speaker considered this estimate as too high, believing that sufficient allowance had not been made for the advantages that ligneous plants, which are often tall-stemmed, possess over herbaceous species in securing access of their leaves and débris to the waters in which they had been floated and ultimately preserved. He admitted, however, that ligneous species were relatively very numerous in the vegetation of the tertiary period. The proportion of ligneous plants he estimates in the existing flora of Japan at near 40 per cent., in the Southern States 22, Northern States 18, Europe 9 to 12.

* The Tertiary data were throughout derived from the 'Flora Tertiaria Helvetiæ' of Professor Heer.

The intimate relationship traceable between the tertiary and Japanese floras in the numerous characteristic types common to both ; the issue of the ordinal and generic comparisons given above ; the larger proportion of ligneous species in the Japanese than in the Eastern American flora ; and the number of types peculiar, at the present day, to Eastern America and Eastern Asia, compared with the few restricted to Europe and America, the speaker contends, favour the view advanced by Professor Asa Gray in reference to plants, and by Mr. Darwin as to animals, viz., that the migration of forms to which is due the community of types in the Eastern States of North America and the miocene of Europe, took place to the north of the Pacific, an overland communication, it may be supposed, having existed during the tertiary time somewhere about Behring's Straits or the line of the Aleutian Islands. This view is confirmed by the occurrence of miocene vegetable remains in North-west America (including genera yet growing in Japan but lost to America), which prove, further, the temperature of these latitudes to have been at that time sufficiently high to have permitted their existence so far north.

The evidence in favour of the ' Atlantis ' hypothesis might, moreover, be expected to have been more marked in the existing vegetation of the Atlantic Islands than is the case. Professor Heer points out the genera *Clethra*, *Bystropogon*, *Cedronella*, and *Oreodaphne* as common to the Atlantic Islands and America. Japanese species, however, have been described of *Clethra* and *Cedronella* ; and Messrs. Webb and Berthelot limit *Bystropogon* to Atlantic-island species. *Oreodaphne* occurs in South Africa and adjacent islands.

A connexion between these islands and Europe, at perhaps a late period of the tertiary, may be considered as highly probable from the predominance of Mediterranean forms in their flora. The few genera characteristic of the tertiary which they possess may have been derived during this connexion ; but the hypothesis that a continent should have extended westward as far as America, the speaker considered the available botanical evidence did not in the least substantiate.

MISCELLANEOUS.

On the Reproduction of Red Coral.

By M. DE LACAZE DUTHIERS.

M. LACAZE DUTHIERS having been appointed by the Government of Algeria to investigate the natural history of the Red Coral, with a view to the regulation of its fishery, passed nearly a year on the African coast of the Mediterranean, in order to study the reproduction of that Zoophyte. Some of the results of his researches have recently been communicated to the Academy of Sciences.

He finds that the individual polypes of each colony are partly male and female and partly hermaphrodite, and that the individuals of one sex usually predominate over those of the other on particular branches—one branch consisting almost exclusively of male, and an-

other of female polypes. The impregnation of the females is effected through the intervention of the water. Male polypes are seen to send forth small jets of a white liquid, which forms clouds in the water, and contains the male elements.

The seminal and ovigerous capsules are not easily distinguished with a lens; but the microscope shows in the ova the germinal spot and vesicle and the granulations of the vitellus, and in the seminal capsules the spermatozoids and the cells which produce them. The ova and testes are milk-white—the former opaque, the latter slightly transparent. After death, the testes remain white, whilst the ova become yellowish; they are then easily distinguished.

It is at the base of the intestiniform folds and, beneath these, in the delicate membrane which unites them to the wall of the body, that the genital glands are placed. During development, they project out of the plates, and appear to be attached by long and slender pedicels, by the rupture of which they are separated and fall into the general cavity. In this cavity both the transformation of the egg after fecundation, and digestion, are accomplished; so that the same cavity serves at once as a stomach and as an incubatory pouch.

The observation of the development of the ovum was attended with great difficulties; and it was only after passing some time on board a fishing-boat that the author succeeded in tracing it. The ovum, originally naked and spherical, becomes elongated and covered with vibratile cilia. A cavity is then formed in it, which opens externally and finally becomes the mouth. It then acquires the form of a little white worm, and is very active, swimming in all directions, avoiding its comrades when they meet, and rising and descending in the vessels, with the extremity opposite to the mouth always foremost.—*Comptes Rendus*, Jan. 13, 1862, p. 116.

On the Polar Globules of the Ovum, and the mode of their Production, and on the Production of the Blastodermic Cells without segmentation of the Vitellus in some Articulata. By CHARLES ROBIN.

Since Dumortier, most embryologists have indicated under the names of *mucous*, *oily*, or *transparent globule*, *hyaline corpuscle*, &c. a translucent globule which appears on the sides of the embryo. When once produced, it remains under the vitelline membrane, taking no part in the phenomena going on beside it; and it is left behind with the envelope on the hatching of the young animal. Its production paves the way for the segmentation of the vitellus, and consequently for the generation of the cells of the blastoderm.

The point of the surface of the vitellus on which these globules are produced marks, a few hours beforehand, the pole of the vitellus which is about to become depressed and then to form a dividing furrow which by degrees becomes equatorial; hence the name of *polar globules* given to them. This is also the point where the cephalic extremity will afterwards appear, and it indicates the spot at which segmentation will commence.

In animals of which the vitellus undergoes segmentation after the extrusion of the ova, it is at from four to six hours after the latter that the polar globules begin to appear, that is to say, at from twelve to twenty-four hours after the disappearance of the germinal vesicle. Their production takes from two hours to three hours and a half; and about two hours after their completion the segmentation commences.

The mode of production of the polar globules is remarkable: it is a true gemmation from the limpid substance of the vitellus, followed by a constriction and then by the transverse division of the base of the process. It commences by the retreat of the granules of the vitellus from a circular portion of the surface about 0.05 mill. in diameter, leaving the hyaline substance quite clear. In a few minutes this transparent portion forms a hemispherical projection, which afterwards becomes conical. Its base contracts, giving it for a moment the form of a cylinder about 0.02 mill. in diameter, and twice as long; the contraction soon causes a constriction, the projection becomes pyriform, and it rapidly separates from the vitellus, with which, however, it remains in contact. These phenomena last from fifteen to twenty-five minutes, during which the vitellus is the seat of slow deformations, but it resumes its spherical form immediately. The phenomena are reproduced a second time in the Mollusca, and even a third and fourth time in most other animals. In those in which the vitellus does not entirely fill the vitelline membrane, as in *Nephelis*, there are eggs in which the process of the hyaline substance forms at first a long cylinder, which contracts and becomes segmented transversely in three places, forming three polar globules. The globules have no distinct walls or cavities; and the few vitelline granules which pass into their interior show no trace of Brownian movements.

After the completion of the last of these polar globules, or even before this, a very curious phenomenon takes place, characterized by the successive union of two or four globules into a single one, which persists up to the period of exclusion, and in which a cavity distinct from the wall in some species, or from one to three nuclei, or sometimes some granules which did not exist originally make their appearance. This union is accomplished in two modes: sometimes the first-formed globule gradually diminishes in size, its substance passing into the next one until it completely disappears; and when there are more than two globules, the phenomena is repeated until only one remains in contact with the vitellus; in other cases the globules mutually coalesce by the gradual enlargement of their plane of contact. A few moments after the reduction of the polar globules to a single one, segmentation commences; sometimes, however, it is set up a little earlier.

The Mollusca present a peculiarity in this respect. At the moment of the commencement of segmentation, after the union of the polar globules, another and somewhat larger globule makes its appearance, which elevates the preceding one, and strongly refracts light. This second globule rises perfectly formed from the midst of the superficial substance of the vitellus without any preliminary clear space. It at the same time elevates, at the surface of the vitellus, a very

delicate translucent pellicle, of mucous appearance, beneath which all the phenomena of segmentation take place. In unfecundated ova the second polar globule is not produced, any more than the thin pellicle which it elevates; in these no phenomena of segmentation take place in the fresh-water Mollusca, and in most of the marine species. The polar globules produced by gemmation appear, but they remain distinct and contiguous.

Hitherto observation has led to the supposition that the first cells of the embryo are always formed by the segmentation of the vitellus; but the author has found that there are certain animals in which the segmentation of the vitellus does not occur, although their fecundated ovum presents a very distinct blastoderm. The production of the blastodermic cells, which marks the close of segmentation in other cases, takes place here by a process of *gemmation*.

This phenomenon is observed most distinctly in the eggs of the Culiciform Tipulidæ, in which the whole of the blastodermic cells, and not merely the polar globules, are produced by gemmation. The same thing probably takes place in the other Tipulidæ, but the imperfect transparency of the envelopes of their eggs renders observation difficult. The arrangement of the blastoderm in the Muscidæ leads to the supposition that it is formed in the same manner; and the author thinks it possible that similar phenomena may occur throughout the Diptera.

These phenomena are described as follows by M. Robin:—The vitellus, which up to the deposition of the egg completely filled the vitelline membrane, is retracted, and immediately afterwards the production of the polar globules commences towards the smaller extremity of the egg. These are produced as above described, and frequently two are formed at the same time close together. They do not, however, coalesce to form a single globule, but, on the contrary, increase in number by scission. At the same time, a nucleus is gradually developed in them, giving them the character of true cells. Lastly, instead of resting on the side of the embryo almost like a foreign body, they soon take part in the formation of the blastoderm.

In the Culiciform Tipulidæ the cells forming the blastoderm are produced quite independently of any segmentation of the vitellus. They begin to show themselves at the extremity of the vitellus opposite to that at which the polar globules are produced. Coming into existence side by side, they gradually occupy the rest of the surface of the vitellus. It is at the expense of the hyaline substance of the vitellus that the blastodermic cells are produced; and their formation is by a process of gemmation. The surface of the vitellus, observed by transmitted light, presents small hemispherical projections, the elevation of which gradually increases. When their height equals their breadth (which is from 0.0014 to 0.0016 mill.), they begin to be mutually compressed. At an hour or an hour and a quarter after this commencement, the adherent extremity of each projection is gradually constricted, so rapidly as in a few minutes to separate from the vitelline substance with which it was continuous. Thus are produced as many cells as there were projections, forming a single series of colourless, transparent, blastodermic cells surrounding the

rest of the vitellus in all parts, and separating it from the vitelline membrane.

An hour after the completion of this first layer of the blastoderm, a second is produced in the same manner. This is formed of similar cells and without segmentation of the subjacent portion of the vitellus. The latter becomes less and less, darker, and more granular, in proportion as the blastoderm thickens by the gemmation of new cells. After the formation of a third series of cells, the centre of the vitellus consists only of contiguous oily drops, which strongly refract the light.—*Comptes Rendus*, Jan. 13 & 20, 1862, pp. 112 & 150.

On the Young of Leipoa ocellata. By RICHARD SCHOMBURGK.

It has hitherto been supposed that the young birds of the *Leipoa ocellata*, after escaping from the egg, remain for some time in the sand-heaps before emerging to the light of day, because they first show themselves in an advanced state of development. As I was recently plundering a nest for the sake of the eggs, I remarked that one bird was just beginning to break the egg-shell. I took the egg home with me, and placed it under a sitting hen. The next morning the bird had crept out. To my great astonishment, it was clothed, not with down, like other young birds, but with perfectly formed feathers. At the same time, it already showed great wildness and much strength in the feet.

The young birds are not hatched simultaneously, but singly, and they do not keep together. A nest usually contains from ten to twelve eggs; and if these be opened, the young birds are found of all sizes.—*Monatsbericht der Akad der Wiss. zu Berlin*, November 1861, p. 1027.

On a Hybrid Duck. By ALFRED NEWTON, M.A., F.L.S., F.Z.S.

I am indebted to the kindness of my friend Mr. Newcome for the opportunity of exhibiting to the Society a specimen of a fine hybrid Duck, beautifully mounted by Mr. Ellis of Swaffham, which presents several points of interest.

This bird (a male) was bred by Mr. Durham of Bremley Grange, near Ripon, from a male Widgeon (*Mareca Penelope*, Selby) and a female which was a cross between the common Wild Duck (*Anas boschas*, Linn.) and an ordinary farm-yard Duck. It was sent to Mr. Newcome by the intelligent gamekeeper at Hornby Castle, Mr. Anthony Savage, from whom I learn that Mr. Durham has since bred several other hybrids from the same male Widgeon and a female of the domesticated variety of *Anas boschas* known as the "Grey Call-duck." Of these hybrids Mr. Savage informs me that he sent a pair to Mr. Grantley Berkeley, and another pair to Mr. John Hancock.

No detailed notice of the particular cross I now exhibit has to my knowledge been hitherto published, though Mr. Yarrell in the last edition of his work ('B. B.' ed. 3, iii. p. 276) mentions the fact as having occurred, and my friend M. de Selys-Longchamps, who has, it is well known, devoted especial attention to the subject, informed

me about two years ago that he was aware of other instances of such a hybrid. According to the views of the last-named accurate observer, the *Anas bimaculata* of Keyserling and Blasius*—the *Anas glochitans* of Gmelin (but not of Pallas)—is the result of this cross; and Mr. Berkeley has also expressed a similar opinion ('Field,' March 16, 1861). With the greatest deference to these authorities, my own idea is that the birds so denominated have descended from the Wild Duck (*Anas boschas*, Linn.) and the Teal (*Querquedula crecca*, Steph.), as has already been suggested by Mr. Tomes and Mr. Bartlett ('Zoologist,' p. 1698); and I have arrived at this conclusion not only from repeated examinations of the specimens described by Mr. Vigors (Linn. Trans. xiv. p. 559), which are now in the British Museum, but also from having seen several other birds of the same kind in different collections.

The principal distinctions observable between the subject of the present notice and the so-called *Anas bimaculata* are in the greater size of the former, and in the comparative obsolescence of the dark patch which, in that supposed species, separates the lighter-coloured spots on the sides of the head. In the bird I now submit to your notice this patch is reduced to a mere line, scarcely perceptible until looked for. The breast also wants the well-defined dark spots which are characteristic of the hybrid known as the "Bimaculated Duck."—*Proc. Zool. Soc.* Dec. 10, 1861.

On a new Species of Finch, of the Genus Sycalis, from Mexico. By
PHILIP LUTLEY SCLATER, M.A., Ph.D., F.R.S.

In a small collection of Mexican birds lately sent to me for examination by M. Parzudaki, of Paris, I find a little Finch of the genus *Sycalis*, which I propose to call—

SYCALIS CHRYSOPS, sp. nov.

S. brunnescenti-olivacea, capite obscuriore substriato: interscapulio, alis et cauda nigricantibus, fusco marginatis: loris, oculorum ambitu, tectricibus subalaribus et corpore subtus flavis, pectore medio et lateribus obscurioribus, fusciscentioribus: rostro et pedibus fuscis.

Long. tota 4.0, alæ 2.6, caudæ 1.6 poll. Angl. et dec.

Hab. In Mexico merid.

Obs. Affinis *S. arvensi*, sed staturâ minore et loris ciliisque aureis distinguenda.

This bird is interesting as the first species of the genus *Sycalis* recorded from the country north of Panama. It was, however, to be expected that the Trans-Panamanian province of the Neotropical region would produce representatives of this, as of other peculiar South-American genera. *Sycalis chrysops* belongs to the same subgroup as *S. arvensis*, but may readily be distinguished from it by its diminutive size.—*Proc. Zool. Soc.* Nov. 26, 1861.

* Several writers assign the authority of Pennant for the trivial name "*bimaculata*." I cannot trace it further back than the 'Wirbelthiere Europas' of the naturalists I have mentioned. There is no question about the *Anas glochitans* of Pallas being a good species, but I do not know any recorded instance of its occurrence in Europe.

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XXXVIII.—*On the Calathi of the Canary Islands.*

By T. VERNON WOLLASTON, M.A., F.L.S.

ALTHOUGH there are probably few groups of Geodephagous Coleoptera less attractive than *Calathus*, yet, from the important part which it plays in the insect-population of the Atlantic Islands, I have thought that the following descriptive enumeration of the various members of it as yet detected at the Canaries may not be altogether without interest, at least to those entomologists who are occupied more particularly in the question of geographical distribution. When we consider that the last revised catalogue acknowledges but 20 unequivocal species of this genus for the whole of Europe, it seems scarcely credible that so many as 16 (and all of them apparently endemic) should have been observed, up to the present time, in this small archipelago; and yet, even whilst allowing a wide margin for aberration, which we may reasonably suppose to have been considerable where the twofold influence of altitude and long isolation has been brought to bear upon the several forms, I have not been able, after a careful study of an extensive series of specimens, collected in the different islands and at numerous heights above the sea-level, to reduce them satisfactorily to a smaller number.

The Canarian type of *Calathus* is rather a singular one, being remarkable for its more or less flattened form and elliptic outline. In Teneriffe there is an additional peculiarity, which is more or less traceable in most of the species, and strongly expressed in some of them—in the fact of the alternate interstices of the elytra being branded with a longitudinal row of large punctures; and although the exact number of these rounded impressions is essentially variable, the variations seem nevertheless to take place within limits sufficiently well defined to render them an important feature in drawing out the several diagnoses.

They are nearly all of them sylvan insects, the *C. simplicicollis* of Lanzarote, and the *ascendens* and *rectus* of Teneriffe, being apparently the only exceptions. Indeed the *C. ascendens*, which occurs beneath stones at a very lofty elevation (attaining its maximum at about 8000 feet above the sea), would seem to represent in these islands the (European) *C. fuscus* of Madeira. And I may further add that the Teneriffan *C. ciliatus* may perhaps be regarded as the analogue of the *C. vividus* of the latter group, the Teneriffan *C. depressus* as that of the Madeiran *complanatus*, and the *barbatus* from Grand Canary as that of the Porto-Santan *fimbriatus*.

Genus CALATHUS.

Bonelli, Observat. Ent. i. tab. syn. (1809).

§ I. *Tibiæ in utroque sexu (omnino vel fere) simplices.*

a. *Corpus magnum, prothorace postice plus minus angustiore, punctis elytrorum discalibus obsoletis.*

1. *Calathus sphodroides*, n. sp.

C. nigropiceus, subdepressus; capite prothoraceque nitidiusculis, hoc subquadrato postice distincte angustato, ad latera sat late recurvo necnon ante medium paulo rotundato, angulis anticis subobtusis, postice distincte punctato; elytris minus nitidis, striatis, postice subrotundatis; antennis pedibusque rufo-piceis.

Long. corp. lin. 7-7 $\frac{2}{3}$.

Habitat in sylvaticis editioribus Teneriffæ, rarissimus.

The present species and the following one are remarkable amongst the Canarian *Calathi* for their immense size (the *C. ciliatus*, of the second section, being the only one which equals them in bulk), by their prothoraces being narrower behind than in front (a structure of rare occurrence in this genus), and by the discal punctures of their elytra being obsolete. *Inter se* they may be known by the *C. sphodroides* being darker than its ally, by the different shape of its (more basally punctured) prothorax, and by its elytra being somewhat less flattened, rounder posteriorly, and not so acuminate at their apex. It is extremely rare, and confined to the sylvan regions of Teneriffe, at intermediate and rather lofty elevations, the only specimens which I have seen (seven in number) having been captured by myself, beneath loose rotting bark, at the Agua Garcia and in the woods above Taganana.

2. *Calathus acuminatus*, n. sp.

C. piceus vel rufo-piceus, depressus; capite prothoraceque nitidiusculis, hoc subquadrato postice paulo angustato, ad latera late recurvo necnon in medio paulo rotundato, angulis anticis porrectis

subacutis, postice leviter punctato ; elytris minus nitidis, striatis, apice acuminatis ; antennis pedibusque læte rufo-ferrugineis.

Long. corp. lin. $7\frac{1}{2}$ – $7\frac{2}{3}$.

Habitat Teneriffam sylvaticam, in iisdem locis ac præcedens.

As may be gathered from the above diagnosis, the *C. acuminatus* may be known from the last species by its more piceous or rufescent hue ; by its prothorax being less conspicuously narrowed behind, with the sides more elevated and more *regularly* rounded in the middle (instead of *before* the middle, as in that insect), less punctured towards the base, and with its anterior angles more porrected and acute ; by its elytra being flatter, and more acuminate at their apex ; and by its limbs being of a uniformly paler tint. It occurs in precisely the same spots as the *C. sphodroides*, being peculiar (so far as I have observed hitherto) to the wooded districts of Teneriffe. Although very rare, it is not quite so scarce as its ally. I have taken it in the forest-region of the Agua Mansa, above Ycod el Alto, and at the sides of the Vueltas leading down from the Cumbre to Taganana.

b. *Corpus minoris magnitudinis, prothorace postice (ut in Calathis typicis) plus minus latiore, punctis elytrorum discalibus plus minus distinctis.*

3. *Calathus rufo-castaneus*, n. sp.

C. rufo-castaneus, subdepressus ; capite prothoraceque nitidissimis, hoc transverso-subquadrato postice paulo latiore, ad latera subpellucido late recurvo ; elytris minus nitidis, striatis, interstitiis depressis, tertio punctulis 3–5 minutis notato ; antennis pedibusque testaceis.

Long. corp. lin. $5\frac{1}{2}$ –6.

Habitat in elevatis humidis sylvaticis Teneriffæ, rarissimus.

The pale rufo-castaneous hue of this distinct and rather large *Calathus*, in conjunction with its highly polished head and prothorax (the latter of which is a good deal recurved, and somewhat pellucid, towards the edges), the minute size of the discal punctures of its elytra, and its testaceous limbs, will at once separate it from the other species here described. Only nine examples have hitherto come under my notice, and it may be considered, therefore, as decidedly rare. They were all taken in the wooded region above the Agua Mansa of Teneriffe ; so that the species is probably peculiar to the upper portion of the sylvan districts.

4. *Calathus carinatus*.

C. piceus, depressus ; capite prothoraceque nitidis, hoc angusto, elongato-subquadrato postice vix angustiore, ad latera sat recurvo ; elytris ellipticis, complanatis, linea basali in utroque valde profunde arcuata, valde opacis, striatis, interstitiis valde depressis, tertio

punctis circa 5-9 et quinto 2-4 (interdum etiam septimo 1-2) distinctis notatis; antennis pedibusque piceo-testaceis.

Long. corp. lin. $4\frac{1}{2}$ - $5\frac{1}{2}$.

Calathus carinatus?, Brullé, in Webb et Berth. (Col.) 55 (1838).

Habitat Teneriffam, in iisdem locis ac præcedens, sed sat vulgaris.

A most remarkable species, at once known by its narrow, elongate-quadrate prothorax, and by its extremely depressed, opaque, and elliptical elytra, which have the basal line of each (from either shoulder to the scutellum) very deeply curved, and their discal punctures (of which there are usually from five to nine on the third, from about two to four on the fifth, and *occasionally* one or two on even the seventh interstice) exceedingly distinct. I have but little doubt that it is the *C. carinatus* of M. Brullé; for, although I was not able, whilst in Paris, to obtain a sight of his *Calathi*, yet I think there is just sufficient in the description (if "description" it may indeed be called) to render it probable that this is the insect to which he referred, though his total silence on all the salient peculiarities of the four Canarian species which he wished to indicate (one of which is no *Calathus* at all, but an *Argutor*!) renders his diagnoses utterly worthless.

The *C. carinatus* is rather common throughout the sylvan regions of Teneriffe. I have taken it abundantly at the Agua Garcia, as also in the woods above Taganana and at Las Mercedes, in the last of which localities it was also found by the Barão do Castello de Paiva.

5. *Calathus advena*, n. sp.

C. pallide fusco-piceus, depressus; capite prothoraceque nitidiusculis, hoc angustulo, subtrapeziformi, postice lato, ad latera paulo recurvo; elytris ovatis (pone medium ampliatis), subopacis, linea basali in utroque subrecta, striatis, interstitiis subconvexis, tertio punctis duobus notato; antennis pedibusque longiusculis, graciliusculis, rufo-testaceis.

Long. corp. lin. $3\frac{3}{4}$.

Habitat Canariam Grandem, tempore vernali A.D. 1858 specimen unicum (sc. masculum) inveni.

The present *Calathus* is the only one of which I have not an extensive series to compile my diagnosis from, the single specimen which I have seen being one which I captured in Grand Canary (I believe in the region of El Monte) during the spring of 1858. Fortunately, however, it happens to be a male, so that I can have no hesitation (from its simple unfimbriated tibiæ) as to which of my sections it belongs to. It is remarkable for its basally wide (though *altogether* not very broad) prothorax, for its subopaque ovate elytra (which are a good deal expanded behind the

middle, and have, in the example before me, but two punctures developed on their disk), for its fusco-piceous hue, and for its rather elongate, slender limbs. There is certainly no species here enumerated to which it could possibly be referred.

6. *Calathus abaxoides*.

C. piceus, subellipticus, nitidiusculus; prothorace subtrapeziformi, postice lato, ad latera antice haud, postice vix recurvo, angulis posticis subacutis; elytris postice paulo convexis subattenuatis, striatis, interstitiis subconvexis, tertio punctis 3-5 sat distinctis notato; antennis pedibusque piceo-testaceis.

Long. corp. lin. $3\frac{2}{3}$ -4.

Calathus abaxoides?, Brullé, in Webb et Berth. (Col.) 56 (1838).

Habitat in sylvaticis humidis Teneriffæ, sat frequens.

I refer this insect to M. Brullé's *C. abaxoides* from the mere fact of the latter's specific name, there being no other Canarian *Calathus* which could be compared in outline to an *Abax*; but since he says that the *abaxoides* is much of the same form as his following species, the *C. angularis* (which is an *Argutor*, and no *Calathus* at all), and since he speaks of it as "cinq* lignes de longueur," whilst it is only *four*, I cannot but feel doubtful, in the absence of even a single *distinctive* character in his "diagnosis," whether it be correctly identified. It may be readily known by its small size, elliptical outline, and the almost *equally* shining surface of its prothorax and elytra, the former of which is broad posteriorly and almost unrecurved at the sides (except slightly so towards the basal angles); whilst the latter are gradually somewhat narrowed behind, with their interstices slightly convex, and with their discal punctures (from three to five on the third interstice) pretty evident.

The *C. abaxoides* is rather abundant throughout the sylvan regions of Teneriffe, occurring in exactly the same places as the last species. I have observed it more particularly at the Agua Garcia, Taganana, and Las Mercedes. It has also been communicated by the Barão do Castello de Paiva and Professor Heer of Zurich, who obtained it from M. Hartung.

7. *Calathus ascendens*, n. sp.

C. fusco-piceus, subdepressus, subnitidus; capite prothoraceque vix rufescentioribus hoc transverse subquadrato, postice vix angustiore,

* So far as the *sizes* of his insects are concerned, I can place no dependence on them at all; and my impression is that he has *transposed* the relative lengths of his *C. depressus* and *abaxoides*. And that this is not mere conjecture, in accordance with the immense series of specimens now before me, is rendered quite certain from the fact that, whilst stating his *C. depressus* to be only four lines long, I find, by actual measurement of the length given for it in *his own* plate, that it is exactly *five*!

ad latera pallidiore et sat recurvo; elytris linea basali in utroque arcuata, striatis, interstitiis subdepressis, tertio punctis circa 3-7 distinctis notato; antennis pedibusque rufo-testaceis.

Long. corp. lin. $4\frac{2}{3}$ - $5\frac{1}{3}$.

Habitat sub lapidibus in montibus Teneriffæ, usque ad 8000' s. m. ascendens.

The present *Calathus* (which I have observed only in Teneriffe) is essentially an inhabitant of the loftiest elevations, attaining its maximum at about 8000 feet above the sea, and but rarely descending into the sylvan districts. It may be known by its only slightly shining surface, fusco-piceous hue, and rather large size; by its prothorax (which is a little rufescent at the edges, and not much recurved) being about equally narrowed before and behind; and by the discal punctures of its elytra being well developed and distinct. I took it in profusion, during May of 1859, from beneath stones, on the Cumbre adjoining the Cañadas, above Ycod el Alto, as also on the opposite Cumbre above the Agua Mansa. In both instances, however, I observed a few stray specimens at a rather lower altitude, namely, *almost* at the Agua Mansa and Ycod el Alto themselves; but as even those spots could not be less than some 5000 feet in elevation, there can be no doubt that the *C. ascendens* must be regarded as an alpine species.

8. *Calathus rectus*, n. sp.

C. subdepressus; capite prothoraceque nitidissimis, rufo-piceis, hoc subquadrato, postice vix latiore, ad latera pallidiore et paulo recurvo; elytris piceis, obscurioribus, linea basali in utroque rectissima, leviter striatis, interstitiis depressis, tertio punctis plerumque 3 sat distinctis notato; antennis pedibusque testaceis.

Long. corp. lin. 4- $4\frac{1}{3}$.

Calathus fulvipes?, Brullé [nec Lat.], in Webb et Berth. (Col.) 56 (1838).

Habitat in locis inferioribus et intermediis Teneriffæ, passim.

In their very shining head and prothorax, and duller (though scarcely opaque) and lightly striated elytra, as well as in their general hue and comparatively smaller size, the present *Calathus* and the following one have much in common. Nevertheless the *C. rectus* is the larger and flatter of the two, and has its limbs considerably longer; its head and prothorax also (the latter of which is a trifle more elongate and wider behind, and has its edges more evidently recurved) are more rufescent; and the basal line of its elytra (extending from either shoulder to the scutellum) is less arcuate, being, in fact, almost perfectly straight. Whilst the following species occurs only (so far as I have observed hitherto) in Lanzarote, the *C. rectus* is scattered sparingly over the lower and intermediate elevations of Teneriffe. I have

taken it near St^a Cruz and Orotava (at the latter of which it was likewise found by Mr. Gray), as also on the mountains above Taganana; and it has been communicated by the Barão do Castello de Paiva from Las Mercedes.

I have but little doubt, from its size and superficial aspect, that it is the insect referred by M. Brullé to the European *C. fulvipes*, with which, however, it has, in reality, nothing (except its generic characters) in common.

9. *Calathus simplicicollis*, n. sp.

C. piceus, angustulus, subconvexus; capite prothoraceque nitidissimis hoc subquadrato, postice vix latiore, ad latera anguste pallidior et vix recurvo; elytris obscurioribus, linea basali in utroque paulo arcuata, leviter striatis, interstitiis depressis, tertio punctis plerumque 3 sat distinctis notato; antennis pedibusque breviusculis, testaceis.

Long. corp. lin. 3–3 $\frac{3}{4}$.

Habitat Lanzarotam borealem, tempore hiberno et vernali, sat frequens.

As may be gathered from what has already been said, the present *Calathus* (which seems to be peculiar to Lanzarote) differs from the last one in being a little smaller, narrower, and more convex, of a slightly darker hue, and with its limbs considerably shorter. Its prothorax, also, is somewhat less conical, with the sides more narrowly rufescent and less recurved; and the basal line of its elytra (joining either shoulder with the scutellum) is more arcuate. It is about the size and general outline of the common European *C. melanocephalus*, of which it is just possible (though, I think, hardly likely) that it may be but a geographical state. It differs, however, from all the specimens and all the varieties of that insect which I have yet seen (including the *peltatus*, Kolen., the *ochropterus*, Dufts., and the *alpinus*, Dej., for types of which I am indebted to my friend Dr. Schaum) in having its prothorax *totally free* from the slightest trace of the two basal foveæ which are always *more or less* expressed in that insect, as also a trifle wider posteriorly, and *perfectly unmargined* behind the hinder angles, which are themselves a little more sharply defined (or, more strictly, *right angles*); its head, too, is altogether *thicker* and more developed, with the eyes less prominent, with the incrassated edge of the clypeus (immediately behind the insertion of the antennæ) more rounded, and with the forehead more convex; and its colour (on which, however, I lay but little stress) is different, its head being somewhat redder (or less black), whilst its prothorax is not *so red* (or more infuscated). Its elytra also are perhaps a little more shining and less depressed. The only locality in which I have hitherto taken the

C. simplicicollis is the extreme north of Lanzarote, where it is not uncommon in the rocky ground behind the Salinas and about the Risco.

§ II. *Tibiæ posteriores maris intus plus minus dense fimbriatæ.*

10. *Calathus ciliatus*, n. sp.

C. fusco-piceus, depressus; capite prothoraceque subnitidis, hoc inæquali, subquadrato, postice latiore, ad latera paulo pallidiore late et valde recurvo; elytris sub-oblongis, linea basali in utroque paulo arcuata, striatis, interstitio tertio punctis circa 8-10 et quinto circa 4-6 distinctis notatis; antennis pedibusque elongatis, rufo-testaceis.

Mas elytris subopacis, interstitiis subconvexis; tibiis posterioribus intus densissime fimbriatis.

Fœm. elytris opacis, interstitiis valde depressis; tibiis simplicibus.

Long. corp. lin. 7-8.

Habitat in montibus excelsis plus minus sylvaticis Teneriffæ, hinc inde sed rarus.

The large size of the present *Calathus** and the following one will easily separate them from the other species of my second section. *Inter se* they are at first sight a good deal allied; and before examining them closely, I had imagined that they were but phases of one insect. A more accurate inspection, however, of *the sexes of both* has convinced me that they are probably distinct, since they preserve their characters, apparently, without variation. The *C. ciliatus* is somewhat the more bulky of the two, being always broader than its ally, and on the average a little longer. It may, however, be additionally known by its prothorax being more especially wider and less conical; by the basal line of its elytra being much less deeply arcuate, causing the shoulders to be less porrected; by the punctures of its third and fifth interstices being usually less numerous; by its elytra (which are a trifle brighter and with their intervals less flattened in the *male* sex) being more oblong; and by the four hinder tibiæ in the male being fimbriated along a rather greater portion of their inner edge. It appears to occur principally in the upper part of the sylvan regions of Teneriffe; and, indeed, I have not yet observed it below an altitude of about 5000 feet. On the damp ledges and rocks above the Agua Mansa, to within a short distance of the Cumbre, I took it sparingly during May of 1859.

* In the national collection at Paris I observed, a few months ago, specimens of this insect under the name of *C. complanatus*, Dej. That species, however, is confined to Madeira, and is totally distinct from the present one, which has more in common *primâ facie* with the Madeiran *C. vividus*, Fab. In real fact, however, *both* of the Madeiran species belong to a different type from these two Canarian ones,—having the hinder tibiæ of their males simple.

11. *Calathus auctus*, n. sp.

C. fusco-piceus, angustulus, depressus; capite prothoraceque subnitidis, hoc inæquali, angustulo, subconico, ad latera paulo pallidiore late et valde recurvo; elytris subellipticis, linea basali in utroque profunde arcuata (ergo ad humeros valde acutis porrectis), striatis, interstitiis (in utroque sexu) depressis, tertio punctis circa 10-14 et quinto circa 6-9 valde distinctis notatis; antennis pedibusque elongatis, rufo-testaceis.

Mas elytris opacis; tibiis posterioribus intus versus apicem densissime fimbriatis.

Fœm. elytris valde opacis; tibiis simplicibus.

Long. corp. lin. 6-7.

Habitat Teneriffam humidam excelsam, in iisdem locis ac præcedens.

As already implied, the rather smaller size and less widened outline of the present *Calathus* (the prothorax of which is especially narrower and more conical), in conjunction with its more elliptic elytra (which have their basal line more curved, and their shoulders consequently acuter or more porrect) and its more numerous discal punctures, will at once separate it from the last species. It differs also in its males having the elytra somewhat more opaque (with the interstices flatter), and the four hinder tibiæ fimbriated along a rather shorter portion of their inner edge. At the same time, I should add that I am by no means perfectly satisfied that it may not be an extreme state of that insect. The *C. auctus* is found in precisely the same spots as the *ciliatus*, occurring in damp localities at a high elevation on the mountains of Teneriffe. I took it, in company with that species, during May of 1859; and it has been communicated by Professor Heer of Zurich (captured by M. Hartung), as also by the Barão do Castello de Paiva.

12. *Calathus angustulus*, n. sp.

C. pallide fusco-piceus, angustus, subdepressus; capite prothoraceque nitidis, hoc angustulo, subquadrato, postice vix angustiore, ad latera paulo pallidiore anguste recurvo; elytris ellipticis (antice et postice subæqualiter rotundatis), opacis, linea basali in utroque profunde arcuata, striatis, interstitio primo (ad basin) punctis 1-3, tertio circa 12-16, quinto circa 8-12 et septimo circa 8-14 valde distinctis notatis; antennis pedibusque rufo-testaceis.

Mas interstitiis subconvexis; tibiis posterioribus intus dense sed breviter fimbriatis.

Fœm. interstitiis depressis; tibiis simplicibus.

Long. corp. lin. $4\frac{1}{2}$ -5.

Habitat Teneriffam excelsam humidam, sub lapidibus corticeque arborum laxo putrido, rarior.

The comparatively narrow outline and pale reddish-brown hue of the present *Calathus*, in conjunction with the shape of its

prothorax (which is a trifle narrower behind than before) and the exceedingly numerous punctures on the alternate interstices of its *elliptic* elytra, will at once characterize it. It is the only Canarian species on which I have observed punctures on the *first* elytral interval, there being usually two or three at the extreme base. Its smaller size and less-margined, differently shaped prothorax, added to its more-rounded, less-flattened elytra and more numerous impressions, will, apart from other differences, readily separate it from the last species. Indeed, in general contour it has perhaps more in common with the *C. carinatus* than with any other member of the genus here described; but its paler colour, narrower and somewhat less depressed elytra (with their more numerous punctures and less arcuated basal line), in combination with its posteriorly narrower prothorax and the fimbriated hinder tibiæ of its male sex, will immediately distinguish it from that insect. The *C. angustulus* occurs sparingly throughout the sylvan regions of Teneriffe, especially towards their upper limits, where it may be found under damp stones and beneath the loose rotting bark of trees. In such positions I have taken it on the ascent from Ycod el Alto to the Cumbre, at the Agua Mansa, and in the laurel-woods above Point Anaga and Taganana. It has also been communicated by the Barão do Castello de Paiva.

13. *Calathus depressus*.

C. nigro-piceus, latus, subdepressus; capite prothoraceque nitidis, hoc subquadrato, postice lato, ad latera vix pallidiore et paulo recurvo; elytris basi latiusculis, linea basali in utroque leviter arcuata, sat profunde striatis, interstitiis (in utroque sexu) subdepressis, tertio punctis circa 6-10, quinto circa 5-7 et septimo circa 1-3 distinctis notatis; antennis pedibusque piceo-testaceis.

Mas tibiis intermediis versus apicem vix fimbriatis (posticis fere, forsan omnino simplicibus).

Fœm. tibiis simplicibus.

Long. corp. lin. 4-5.

Calathus depressus?, Brullé, in Webb et Berth. (Col.) 55, pl. 2. f. 1 (1838).

Habitat in sylvaticis Teneriffæ, sub lapidibus sat vulgaris.

The dark hue and broad outline of this *Calathus* (the prothorax of which is considerably wider behind than in front, and is but slightly recurved at the edges), added to its rather deeply striated elytra (which are subopaque in both sexes, and have their discal punctures of the number indicated above), will sufficiently characterize it. The hinder tibiæ of the male are almost (if not indeed entirely) simple; and even the intermediate ones are but very shortly and obscurely fimbriated towards their inner apex:

nevertheless the latter are, I think, quite sufficiently so to warrant its admission into my second section. Although M. Brullé's very brief and meagre description applies almost equally to about two-thirds of the Canarian *Calathi*, yet, with the assistance of his figure and of the *size* there given of it (though, as already mentioned, that length does *not* tally with what he states), I believe that this is the insect to which he intended to apply the name of *C. depressus*, and I have consequently quoted it as such.

It is universal within the sylvan districts of Teneriffe, and is perhaps the most common of the Canarian *Calathi*; nevertheless, although widely distributed over the island, I have never met with it in actual profusion anywhere. I have taken it at and above Ycod el Alto, at the Agua Mansa, and at the Agua Garcia, as also at Las Mercedes and in the woods towards Taganana and Point Anaga. I have likewise received it from the Barão do Castello de Paiva, and from Professor Heer of Zurich, who obtained it from M. Hartung.

14. *Calathus appendiculatus*, n. sp.

C. fusco-piceus, depressus; capite nitido; prothorace subæquali, subquadrato, postice latiore, ad latera paulo pallidiore anguste et leviter recurvo, ad basin ipsissimam fere immarginato; elytris linea basali in utroque recta, striatis, interstitio tertio punctis circa 3-5 sat distinctis notato; antennis pedibusque testaceis.

Mas omnino nitidus, interstitiis subconvexis; tibiis posterioribus intus densissimis fimbriatis.

Fœm. prothorace elytrisque opacis, interstitiis valde depressis; tibiis simplicibus.

Long. corp. lin. $5\frac{1}{2}$.

Habitat Canariam Grandem: in montibus sylvaticis inter oppida Galdar et Teror d. 21 Ap. A.D. 1858 pauca specimina collegi.

Apart from all other characters, the peculiar sexual differences of this fine *Calathus* (the males of which are entirely bright, whilst the females have their *prothorax* and *elytra* opaque) will at once separate it from all the others as yet detected at the Canaries. In their elytral impressions, the present insect and the two following ones are on the ordinary type, the number being reduced to three or four on the third interstice, from which it would appear that those species which have them more or less increased are, according to the data hitherto accumulated, confined to Teneriffe. The *C. appendiculatus* seems to be peculiar to the sylvan regions of Grand Canary, where, on the 21st of April, 1858, I captured several specimens of it, beneath moist rotting bark, in the remains of the ancient forest of El Dorames, on the mountain road between Galdar and Teror.

15. *Calathus barbatus*, n. sp.

C. fusco-piceus, subdepressus; capite prothoraceque nitidis, hoc subquadrato postice vix latiore, ad latera pallidiore et leviter recurvo; elytris vix subconvexis et vix obscurioribus, linea basali in utroque subrecta, leviter striatis, interstitio tertio punctis 3-4 distinctis notato; antennis pedibusque testaceis.

Mas interstitiis subconvexis; tibiis posterioribus intus apicem versus dense fimbriatis; posticis subcurvatis.

Fœm. interstitiis depressis; tibiis simplicibus.

Long. corp. lin. $3\frac{2}{3}$ - $4\frac{1}{3}$.

Habitat Canariam Grandem, in regionibus El Monte et Tarajana tempore vernali A.D. 1858 deprehensus.

Like the last species, the *C. barbatus* would appear to be peculiar to Grand Canary,—descending, however, into *sub-sylvan* spots of a rather lower elevation than those tenanted by that insect. It may be known from it by its very much smaller size and by its sexes being almost equally shining, its prothorax being in them *both* (as is the case with all the Canarian *Calathi* except the *appendiculatus*) equally polished. In minor characters, its elytra are a trifle more convex than those of the *appendiculatus*, and have their basal line rather more curved; and the four hinder tibiæ of its males are fimbriated along a rather shorter portion of their inner edge. I took it, not uncommonly, in the region of El Monte, as also on the mountains of Tarajana, during the spring of 1858.

16. *Calathus spretus*, n. sp.

C. fusco-piceus, subconvexus; capite prothoraceque nitidis, hoc subquadrato, postice vix latiore, ad latera paulo pallidiore et leviter recurvo; elytris subconvexis, ovatis, paulo (præsertim in sexu fœmineo) obscurioribus, linea basali in utroque recta, leviter striatis, interstitiis (in utroque sexu) subdepressis, tertio punctis 3-4 distinctis notato; antennis pedibusque rufo-testaceis.

Mas tibiis posterioribus (sed præsertim intermediis) intus versus apicem paulo densius ciliatis.

Fœm. tibiis simplicibus.

Long. corp. lin. 4- $4\frac{1}{2}$.

Habitat in ins. Hierro, mense Februario A. D. 1858 deprehensus.

In general aspect the present *Calathus* comes so near to the *C. barbatus*, that, were it not for the essential differences displayed by the tibiæ of the males of the two species, I should not have hesitated to consider them as identical; but since the former has the four hinder tibiæ of its males *almost* simple internally, and the posterior pair straight, whilst the latter has them powerfully fimbriated, with the posterior ones slightly curved, I cannot but regard them as dissimilar, and so lay greater stress on the *other* minute differences which they display *inter se* than I should ordinarily

have done. Independently, therefore, of this primary distinction (which of itself would be sufficient to separate them), I may just add that the *C. spretus* may be known from its ally by (on the average) its slightly larger bulk and rather darker hue; by its prothorax being perhaps a little less rounded at the sides, and its elytra a little *more* so; and by the latter being just perceptibly more convex and opaque, with their basal line somewhat straighter.

Whilst the *C. barbatus* is apparently confined to Grand Canary, the present species has been observed only in Hierro, where several specimens of it were captured by Mr. Gray and myself during our visit to that island in February 1858.

XXXIX.—*On the Microscopic Life of the Island of St. Paul, in the Southern Ocean.* By PROFESSOR EHRENBERG*.

OASES in great deserts, and islands of difficult access in the distant ocean, often fill the naturalist with a longing desire for a knowledge of the forms of life existing on them. It seems as if something of a virgin nature—something primæval, and not yet profaned by man—might possibly be retained there, the knowledge of which might enable us to see more deeply into the original manifestations of life on our planet. On the other hand, the expectation at least will be excited of finding, together and connected in isolated spots, certain natural variations of a simpler type of life, which elsewhere have been altered by innumerable opportunities of intermixture, until the original forms have become unrecognizable. It is with a feeling of devotion, with a beating heart, that the naturalist, whether young or old, approaches such localities as are closed to common intercourse, regarding them in the light of something sacred. Experience and the quietude of advancing years cool many a warm hope; but the idea constantly awakens freshly that on some distant island some treasure of this kind is to be found,—just as New Holland has retained its Marsupial Mammals, and New Zealand and Madagascar their gigantic birds—living in the one case, in the others scarcely dead.

The small Island of St. Paul, situated in the midst of the Southern Ocean, at nearly an equal distance (3000 nautical miles) from the Cape of Good Hope and Adelaide in New Holland, which was first discovered and named by Antonio Van Diemen, in 1633, as the southernmost of the two islands of Amsterdam

* Translated from the 'Monatsbericht der Berliner Akademie der Wissenschaften,' December 1861, p. 1085.

and St. Paul, has recently been examined with the most devoted zeal and care, at the special desire of Alexander Von Humboldt, by the Austrian circumnavigatory expedition of the frigate 'Novara.' The great distance of this island from the active traffic of the world, and the already published review of the larger forms of life accessible to the naked eye, induced me to submit the cinders and samples of earth sent to me by Professor Hochstetter, the geologist to the expedition, to a careful examination in respect of the microscopic forms of life; and I desire now to append the results of this investigation, as an expression of thanks to the unwearied and most meritorious efforts of that observer.

SHORT DESCRIPTION OF THE ISLAND.

[From the journals of the 'Novara,' by Dr. Scherzer.]

The greatest length of the Island of St. Paul, which, according to the recent observations, is situated in $38^{\circ} 42' 55''$ S. lat. and $77^{\circ} 31' 18''$ W. long., is three nautical miles; its greatest breadth, from S.E. to N.W., two nautical miles; and its total surface 1,600,000 square fathoms. Its form is that of a simple crater-wall surrounding a nearly circular crater-lake, the latter being 3984 Viennese feet in greatest breadth, and 34 fathoms (=204 feet) in depth. The highest point of the crater-margin is 846 Viennese feet above the level of the sea.

The rocks are basaltic lavas, consisting of glassy oligoclase and augite, with intermixed olivine and magnetic iron. From a sharp profile on the eastern side, the petrographic structure of the island may be clearly seen. Here four principal periods of the geological development of the island make their appearance, three submarine and one supramarine, of which more accurate proof is desirable. At present the island is only in the state of a quiescent fumarole. Pure aqueous vapours, without any trace of vapours of sulphurous and muriatic acids, flow forth from the clefts of the inner margin of the crater, and, on the summit of the island, from the fissures of the newest bed of lava.

With regard to the period of the last great geological change, it appears, from the journals of the 'Novara' of the year 1857, that 160 years previously (namely, in 1697, when the Dutch captain Willem de Vlaming saw the island) the entrance to the crater-basin was still closed by a dam 5 feet in height, and that at the present day this entrance is open, for a width of 306 feet, for the admission of boats at all times of the day, and has a depth of 2-3 feet of water at ebb-tide, and of 9 feet at the flood. Whether storms and the action of the waves during the last 160 years have broken down the dam, or whether an internal volcanic movement has assisted in producing the effect, may re-

main doubtful; the alteration in that time is certainly attested. The flames and masses of smoke observed by d'Entrecasteau for two whole days in 1792, on the neighbouring island of Amsterdam, were repeated before the eyes of the naturalists by the accidental ignition of the dry grass, depriving the supposition that the islands were active at that time of its probability.

THE LARGER FORMS OF LIFE.

Great was the anxious suspense of the body of scientific men as they approached the island. As soon as the anchor was dropped, a small boat was seen approaching, with three wild-looking men in it. These human inhabitants were neither aborigines nor shipwrecked seamen, but Frenchmen, voluntary colonists from St. Denis in the Isle of Bourbon, who, for the sake of the fishery, had established themselves near a spring, in the same way as the two sea-bear-hunters who were found settled there, in 1793, by the English man-of-war 'Lion,' and who had remained for more than a year. Twice in the year a ship enables the French colonists to communicate with the Mascarene Islands.

The examination of the island, continued during two weeks and a half by the whole scientific body landed there on purpose, has furnished us with an exhaustive view of all the larger forms of life of this isolated extinct volcano.

Of vegetable forms St. Paul contains neither tree nor shrub; but poppies, parsley, potatoes, and oats, growing wild, gave testimony to the previous settlement of Europeans. Of plants in general, besides the introduced cultivated species and their constant companions *Sonchus arvensis*, *Digitaria*, *Plantago*, *Ceratium*, and *Stellaria media*, the whole island presented 56 species independent of man,—namely, 11 probably aboriginal Phanerogamia (6 Grasses, 1 Cyperacean), 2 Ferns, 1 *Lycopodium*, 3 Mosses, 2 Liverworts, 4 Lichens, and 33 Algæ. The grasses form no meadows but the plants are only closely approximated; nevertheless they constitute the general covering of the soil. Their decay forms the mould, which is sometimes several feet thick.

Of peculiar Mammals there was no trace; but there were pigs, goats, cats, and rabbits, which had become wild, and also rats and mice. The sea-bears (*Arctocephalus falclandicus*), which were formerly abundant, have disappeared, although as late as 1793 the colonists found there were completing a cargo of 25,000 skins, as many animals came daily to the shore.

Of Birds, a peculiar Tern (*Sterna*), a Skua (*Stercorarius antarcticus*), the Broad-billed Petrel (*Prion vittatus*), three species of Albatross (*Diomedea exulans*, *D. chlororhynchus*, and *Phæbetría fuliginosa*) were observed and collected. A species of Pen-

guin (*Eudyptes chrysocoma*) was remarkably abundant. With these widely distributed oceanic birds, there was only a single land-bird, a Swift (*Cypselus*); and the male appeared to be in attendance upon a sitting female.

Of Fishes, a large Acanthopterygian (*Cheilodactylus fasciatus*), allied to the Umbre, constituted the principal object of the sea-fishery. With the hook, *Thyrsites Aton* and a few other forms were taken in the ship; and there were also Sharks.

Of Amphibia the island showed no trace.

Of Insects, with the exception of the introduced Clothes-Moth, there were no *Lepidoptera*; nor were there any *Hymenoptera*, *Neuroptera*, or indigenous *Orthoptera*. There were only one small ground-Beetle, two abundant Spiders, and one very small Homopterous insect (*Delphax hemiptera*). There was also a species of the Isopod Crustacea, and with it our common Wood-louse (*Porcellio*); the Book-louse (*Psocus*), Earwig (*Forficula*), and Flea were also present, and appeared to have been introduced. The Woodlouse was astonishingly abundant, covering the island in such dense masses that one of the naturalists estimated its numbers at 6,000,000,000, assuming 100 specimens as the minimum on one square foot of surface. About the fumaroles they always lay in heaps, dead and scorched. The similar absence of all Butterflies, Sphinges, and Bombyces in Iceland was explained by my late friend, the learned traveller and naturalist, Dr. Thienemann (Reise, 1827, p. 240), by their being more easily destroyed by showers of ashes; whilst *Noctuæ* and *Geometræ* exist in Iceland, and Butterflies live still further to the north.

Of the higher Crustacea, a large *Palinurus* was very abundant in the sea, and proved to be very good eating. The Mollusca, which were not plentiful even in the dredge, were mostly very small. The largest was a *Tritonium*, 3 inches in length, taken in the sea. There were 3 small Brachiopods.

The sum-total of the species of animals enumerated in the general account of the voyage scarcely amounts to 20, independent of human agency.

However possible it might be to add a few fishes and some parasites of the widely distributed birds and of the fishes to the fauna of the island, or to catalogue marine shells and worms in larger numbers than were furnished by the dredge, still the terrestrial fauna, which particularly interests us, has been in fact settled at the above small number of forms by remarkably expert and zealous observers. A few insects which had concealed themselves during stormy and rainy days might probably come forth in the quiet sunshine; and at other seasons of the year a few more species of animals and plants might be collected, which were in-

visible in November and December; but the number of 76 indigenous forms of the larger plants and animals appears to be very nearly the extreme limit of the palpable life of the island, and may be adopted here only as a standard of comparison with the microscopic impalpable life.

THE MICROSCOPIC FORMS OF LIFE.

Professor Hochstetter sent me first of all some specimens of cinders and earths from the base and the elevated surface of the volcano. The increasing interest of the investigation induced me to make special requests, and called forth from Professor Hochstetter further explanations and the transmission of other materials. In this way I obtained fifteen different samples.

Review and Characteristics of the Materials.

a. From the shore and base of the crater.

1. *Sand from the hot place close to the shore of the crater-basin.* No. 171.—The spot is covered by the sea at high water. At a depth of $\frac{1}{2}$ –1 foot, the thermometer rose to 168°, 187°, 196°, 197°·6, and 201° F. The bare foot could not bear to rest on the surface, and was scalded when slightly sunk. The specimen is dry, and consists of a moderately fine sharp sand of a dark-grey colour, with numerous black, yellowish, and white grains, mostly a little coarser than ordinary writing-sand. Acids produce no perceptible effervescence. When heated to redness, many of the dark particles become paler, and the brown ones more yellowish. Ten analyses of the finest parts, suspended in distilled water, gave only a slight intermixture of organic particles in a greatly predominating mass of sand composed of cindery fragments of different colours, many of which were doubly refractive. Only two Polygastria and three Phytolitharia could be particularly registered; they were all completely isolated. From the scanty intermixture of the latter, this sand evidently has no connexion with the humus of the island; and although the two Polygastria establish beyond a doubt a connexion with the neighbouring sea, all the intermixed calcareous particles of sea-sand are wanting. The sand consequently consists of fine cindery particles, and of a few accidentally introduced terrestrial and marine organisms of the smallest size.

Each of the analyses here given relates, as in other cases, to about one-third of a cubic line (a portion as large as a pin's head) of the mass, spread thinly with water upon mica, dried, and coated with Canada balsam: every particle of this, however small, was examined with a power of 300 diameters.

2. *Stone from the hot spring, coated with calcareous incrustations and Oscillatoria.* No. 167.—I have received two breccia-like, coarsely granular, but not porous specimens of stone, nearly 2 inches in diameter, exhibiting, in a black fundamental mass, white amorphous grains, often 1 line in diameter, and sometimes separable, which are glassy at their margins, but mostly opaque in the middle. The spring has a temperature of 131° F., a somewhat alkaline reaction, and a strongly mineral taste. At high water it is covered by the sea. The specimens have formed the walls of a natural supply-pipe. Muriatic acid dissolves a portion of the incrusting coat with effervescence; a considerable portion remains unaltered. Of the latter a portion is felt-like, and composed of very delicate organic elements; another portion is earthy. The felty masses are partly of a green colour (they were living), partly colourless or white (dead?). The green portions are entirely felted *Oscillatoria*, one of which (a very fine one) closely resembles *O. labyrinthiformis*; the other, which is rather coarser, is of a more vivid green. The pale-yellowish and white felted masses are made up of the same forms bleached, but also frequently of dense colonies of hitherto unknown forms (*Phalarina Wüllerstorffii*, *Cymbopilea Novaræ*, *Collossigma Scherzeri*, and *Collorhaphis Sellenyi*), amongst which various other forms lie isolatedly. The total result of twenty analyses enables us to register, besides the *Oscillatoria*, 14 Polygastria, 4 Phytolitharia (of which 3 are Spongolithes) and 1 Lepidopterous scale. The new genera are mostly amorphous jellies, in which scattered and densely aggregated *Naviculacea* lie without order.

3. *Cinder from the coast, covered with Serpulæ.* X.—The fragment of cinder, rather more than 2 inches in diameter, is very porous, with the principal mass dark brown; it resembles a firmly cemented dark-brown sand, and has white enclosed grains, glassy at the margin, and not acted upon by acids, like those in No. 2. The *Serpulæ* are mostly covered with a thin green coat of Algæ. The fragment, previously freed from all foreign dust by strong blowing on all sides, was repeatedly shaken strongly, in a suitable vessel, with distilled water, by which a slight turbidity of the water was produced. In the deposit there were, in twenty analyses, 42 organic forms:—viz. 12 Polygastria, 12 Phytolitharia, 14 Polythalamia, 2 Polycystina, 1 Bryozoon, 1 Zoolitharion.

4. *Coarse black sand from the shore.* No. 154.—The sand resembles coarse gunpowder, and only contains a few whitish silicious particles. Many of the black grains follow the magnet, and appear to be a magnetic iron-sand. There were no organic forms.

b. *From the upper surface of the volcano.*

5. *Bog iron-ore from the upper margin of the crater.* Y.—The sample consists of some fragments, an inch or more in diameter, of a deposit resembling bog iron-ore, coarsely granular, full of holes, and of a reddish-brown colour. The weathered surface is whitish; the fresh fractures exhibit many cavities, several lines in diameter, filled with a red, ochrey, friable earth. Here and there glassy streaks of greater solidity occur in the mass. Acid is absorbed without effervescence; calcination produces no change in the red colour. After the surface had been well blown, the bright-red friable inner parts were crushed in distilled water, and, after the clear water had been poured away, boiled with muriatic acid. The fluid became greenish, and a whitish silica, free from iron, remained behind. Ten analyses of this mass furnished 16 striking organic forms:—6 *Polygastria*, 6 *Phytolitharia*, 3 *Polycystina*, 1 *Geolithe*. Decided marine forms were mixed with very striking freshwater forms, otherwise than in the other cases.

6. *Bright-red earth from the highest points of the island, under the turf.* No. 164.—The entire upper margin of the crater presents red earth of this kind, apparently the upper beds of lava and cinders decomposed into iron-ochre or brown ironstone. The sample is a bright, rusty-red, fine earth, which does not effervesce with acid, and, when calcined, becomes first blackish, and afterwards only a very little darker, at last even resuming its original colour. In washing, the greater part is suspended in the water, and only a few sand-grains remain; these, also, form rough particles between the fingers, whilst the mass is of impalpable fineness. When the red earth is boiled with muriatic acid, iron is extracted, and a white earth, scarcely diminished in volume, is left.

This earth is exceedingly remarkable when examined by the microscope. It consists, with the exception of a very few quartzose glassy sand-grains, entirely of well-preserved fine, and coarser silicious particles from grasses, with a few shells of *Polygastria* intermixed. That these particles, covered individually with a thin coat of peroxide of iron, which ceases to be perceptible under a magnifying power of 300 diameters, were produced, as might be supposed from appearances, by the weathering and decomposition of beds of lava and cinders, is impossible, from the sharpness and good preservation of their forms; but a baking and hardening of the decomposed grassy vegetation to form superficial cindery rocks, and an action of the volcano upon such masses, colouring them with peroxide of iron, is readily conceivable even at a high temperature; the circumstance that the oxide of iron in them is

not a hydrate, but anhydrous oxide of iron, and therefore quite distinct from the very similar iron-ochre, is favourable to this view. (Compare No. 5.) Ten analyses have enabled 25 Phytolitharia, amongst which is 1 Spongolithe and 1 Polygastrian, to be determined as *constituent* elements. The small quantity of inorganic sand is not glassy, but strongly doubly refractive; and the behaviour of its white particles resembles that of the white portion of the cinders indicated as oligoclase. The *Lithosphæridia* predominate, and are the smallest forms. *Lithostylidium rude* is large, and often very numerous. Although the *Lithosphæridia* have their outlines always sharp and smooth, the *Lithostylidia* usually appear spongy and, as it were, eaten away. One of their chemical constituents appears to have been extracted from them. The stelligerous forms, described as *Lithosemata*, occur not unfrequently.

7. *Dark-brown earth under the turf of the most elevated surfaces.* No. 166.—The fine dark-brown earth, which becomes black when wetted, does not effervesce with acids. When calcined, it becomes first blackish, and then of a darker brown than before. It contains many root-fibres of plants, which are visible to the naked eye. When washed, there remains a fine variegated sand in which many Phytolitharia are imbedded. *Lithosphæridia* are rare; but *Amphidiscus truncatus*, *Lithostylidium clepsammidium*, and *L. rude* are abundant. No *Lithosemata*. In all, ten analyses gave 4 Polygastraria and 21 Phytolitharia, such as particles of grasses, but no Spongolithe.

8. *Dark-brown earth under the turf of the highest region of the island.* No. 165.—Dull dark-brown earth, which does not effervesce with acids, and, when calcined, becomes first black, and then white. Impalpable when rubbed between the fingers. In ten analyses, 24 organic forms were found; these were all silicious particles of grasses, except 1 Spongolithe, most probably blown in.

In the form, abundance, and intermixture of the forms, this earth exactly resembles the red earths Nos. 5 and 6. Only a small quantity, disappearing in the mass, of decomposed vegetable cellular tissue (true humus) is intermixed with it; but still this is the part which gives the brown colour. Iron, on the contrary, is entirely wanting. This fact is important, because by it the iron in Nos. 5 and 6 is shown to be a foreign intermixture, not appertaining to those grass-particles, and either produced by volcanic action or by non-volcanic deposition from water. The apparently black humus of the island, where quite free from volcanic dust, is only formed by Phytolitharia with a little soluble cellular matter, and without lime.

9. *Red fumarole-clay on the plateau at the highest margin of the crater.* No. 197.—The specimen is a yellowish-brown, dry, friable, clayey earth, dried into lumps, and plastic when moist, which has a sharp sandy feel when rubbed between the fingers. The colour is a rather duller red, and more like loam, than that of No. 5. On the addition of acids, no effervescence or other change is produced. When calcined, the mass becomes first blackish, then reddish brown, darker than before, and not blood-red. When boiled with muriatic acid, it becomes very pale and whitish. Under a magnifying power of 300 diameters, the mass appears like a very fine clay. Ten analyses gave only 3 recognizable forms as organic elements. By the washing of the finest clay, the sharply sandy residue in a watch-glass gave numerous *Lithostylidia*, but only a few well preserved. Various half-decomposed bacilliform fragments might belong to the same forms. The most remarkable forms were numerous spherules, often of very small size, which were unaltered by boiling in muriatic acid, round or oval in shape, very smooth and finely cellular in the interior. As I once found four of them adhering together, the middle one being smaller and also of irregular shape, I have indicated these structures as hyalithic Morpholithes. They often resemble a *Haliomma*; they contain air in their interior within numerous small cells, into which balsam gradually penetrates from the surface. With polarized light, they often, but not always, become opalescent. The latter characteristic excludes them very distinctly from the organic forms.

10. *Moss-turf from a soil of moist blackish-brown humus.* No. 6.—The sample is a dense satiny moss-turf, without fructification; it is probably a *Bryum*. After softening and squeezing a portion in distilled water, there occurred, as a turbidity, in ten analyses, 8 Polygastria (6 Diatoms) and 16 Phytolitharia, amongst which are 2 Spongolithes; together, 24 organic forms. Brown irregular particles, amongst which were many small fragments of Phytolitharia, predominate. *Pinnularia borealis* and *Lithostylidium rude* are very abundant; the rest occur singly.

11. *Bright-green moss upon black humus.* No. 7.—The sample is a moss-turf with large bright-green stems, resembling a *Hypnum*, and adherent traces of Lichens (*Cladonia*). Such bright-green moss showed itself on the declivities of the volcanic cone, near the highest margin of the crater, on the hottest places. When stirred in distilled water, the earth furnished, in ten analyses, 8 Polygastria and 15 Phytolitharia; together, 23 forms. Amongst much brown rotten cellular tissue, *Lithostylidia*, *Ar-*

cella globulus, and *Pinnularia borealis* are particularly plentiful; *Eunotia amphioxys* is rare.

12. *Bright-green moss-turf from a hot place.* No. 12.—A fragment of a loose moss-turf, with a slight coat of lichens (*Cladoniae*) and various mosses, from the upper margin of the crater. In ten analyses of the finest particles, in portions of the size of a pin's head, diffused under water and covered with Canada balsam, 6 Polygastria, 18 Phytolitharia, and 1 egg of a Tardigrade, altogether 25 forms, were observed. The greatest part of the layer of humus consists of rotten cellular tissue, appearing brown by transmitted light. *Lithostylidia*, and especially *Pinnularia borealis*, are extremely plentiful, together with *Diffugia seminulum*. *Eunotia amphioxys* is not rare; the rest occur singly.

13. *Green coating on humus on moist declivities.* No. 9.—The sample consists of thin black parings of the layer of humus, with the upper surface greenish. Softened and suspended in distilled water, the fine deposit in the watch-glass showed 28 organic structures in ten portions of the size of a pin's head, namely, 11 Polygastria, 16 Phytolitharia, and 1 Tardigrade; amongst these there were cellular parts of grasses with fissures. The greater part of the Polygastria are *Arcellina*, and the two cosmopolite forms *Pinnularia borealis* and *Eunotia amphioxys*. The Phytolitharia are only portions of grasses. The Tardigrade is not rare, and cannot be distinguished from the very widely distributed *Macrobotus Hufelandii*.

14. *Moss-turf of Sphagnum, without any earthy soil.* No. 10.—The sample consists of four clean stems, 3 inches long, without fructification. When softened in distilled water, and repeatedly squeezed, the half of them produced a slight turbidity in the water. Ten analyses of the deposit in the watch-glass furnished 6 Polygastria, 7 Phytolitharia, and 2 small seeds; together, 15 forms. *Diffugiæ* are very numerous, especially *D. seminulum* and *Frauenfeldii*; of the former there were sometimes from four to six at once in the field.

15. *Green Liverwort-turf upon moist black humus.* No. 13.—The specimen, which was about two inches across, contained chiefly *Jungermannia*; but amongst these there were many fern-capsules and seeds. Ten analyses of the finest earthy particles furnished 31 forms, namely, 10 Polygastria, 14 Phytolitharia, 3 Rotatoria, 1 *Anguillula*, 2 small seeds, and a portion of a plant resembling the epidermis of a grass. The *Arcellina* predominated amongst decayed parts of plants, especially *Diffugia areolata*. The Rotatoria are not rare, but never occur many together. The *Diffugiæ* appear to reside with them in the axils of the leaves of the plant.

Results.

The whole of the microscopic forms of the Island of St. Paul thus brought to light are—

Organic silicious forms.

- 35 Bacillariæ (Polygastria).
- 5 Polycystina.
- 67 Phytolitharia.
- 2 Geolithes.

Calcareous forms.

- 14 Polythalamia.
- 1 Bryozoon.
- 1 Zoolitharion.

Soft forms.

- 3 Rotatoria.
- 2 Tardigrada.
- 1 Anguillula.
- 13 Arcellina (Polygastria).
- 1 Lepidopterous scale.
- 7 Portions of plants.
- 2 Oscillatoria.

154

Inorganic forms.

- 7 kinds.

161

To these may be added isolated mouse-hairs and dyed blue and red fibres of wool, originating from the clothes of men or from filter-paper.

Of the whole 161 kinds, 76 are independent organisms; the other organic forms are characteristic parts of larger organisms, mostly grasses and sponges.

Of inorganic characteristic forms 7 are registered.

Besides these 154 organic and 7 inorganic forms, *no traces of any others could be detected* with a power of 300 diameters and even more.

The whole of the structures registered belong to the six classes already indicated in the 'Mikrogeologie' as widely distributed on the earth, and to their well-known families. But among them there are six forms which had to be described under new generic names, and which therefore may be particularly characteristic of this small island. These are the genera *Collorhaphis*, *Collosigma*,

Cymboplea, and *Phalarina* amongst the Diatomæ; *Chætetrochus* amongst the Polythalamia; and *Lithosema* amongst the Phytolitharia.

In all, there are 29 forms out of the 154 which have never been observed elsewhere by me; namely, 15 Polygastria, 11 Phytolitharia, 1 Polythalamion and perhaps more, and 2 Rotatoria. Of these 18 are independent organisms.

If they be divided into terrestrial and marine forms, 48 out of the 154 organic forms belong to the sea, the remaining 106 being land and freshwater organisms.

As Tardigrada and Rotatoria were to be detected in some of the specimens, I immediately tried with great care whether they would give any signs of life in water, or whether they could be brought to full vital activity, which has usually been erroneously described as a resuscitation from death. The dry materials, which were collected in December 1857, and reached me in 1861, and were consequently more than three years old, exhibited no signs of vitality in any of the forms in which these were expected, although in previous experiments with materials from other localities I had been able to observe life still retained even for four years. We can revive no dead organisms, even the smallest!

There is, however, no doubt that the independent microscopic life of the island cannot be regarded as completed by these 76 independent forms. By observations quietly and specially directed to them, the stagnating snow and rain-water or the muddy earth, however little it may strike the eye, may present numerous other forms which disappear after death, as I found to be the case in the deserts of Africa forty years ago.

Of the 76 independent minute forms, 8 are shellless animals (*Anguillulæ*, *Rotatoria*, and *Tardigrada*), 13 *Arcellina* with membranous carapaces, 40 silicious-shelled (*Diatoms* and *Polycystina*), and 15 calcareous-shelled (*Polythalamia* and *Bryozoa*).

Several of the independent forms bearing silicious shells are very numerous in their localities; but there exists no *Kieselguhr*, tripoli or polishing-slate formed by them. On the contrary, the so-called humus-soil is formed principally of the 57 silicious particles of grasses, some, however, with *Naviculaceæ*.

As, according to the investigations of the botanists of the expedition, there were only 11 indigenous Phanerogamic plants and only 7 grasses upon the island, the whole of the 57 silicious particles of grasses which form the upper soil under the turf are undoubtedly derived from these 7 grasses. The few isolated *Spongolithes* belong to the sea, and never contribute much to the mass.

The grassy soil or humus, which in the upper parts of the

island resembles Kieselguhr, and consists chiefly of Phytolitharia, is black when moist, brown when dry; but in the vicinity of the fumaroles it is often of a bright ochreous rusty red (Nos. 6, 7, 8). By ignition, the black earths become not red, but white. The iron is therefore no constituent of the Phytolitharia, but an extraneous constituent introduced no doubt by the volcanic fumaroles. If the rusty-red earth, which, as reported, appears here and there to be a product of the weathering of bog iron-ore and brown ironstone, behaves everywhere like the samples, we are compelled, on account of its organic composition, to reverse the notion, and to regard the rocks standing in connexion with such earths as consisting of the latter repeatedly baked, hardened and metamorphosed.

The slight mixture of the Phytolitharian humus with inorganic sand and volcanic ashes appears of importance. From this we may undoubtedly draw many conclusions as to the activity of the volcano. If the average annual mass of the humus can be ascertained, we shall be able to judge approximately, from the thickness of the earthy mound, of the last period of repose of the volcano. Showers of ashes must have immediately effected a great change in such pure Phytolitharian humus. The samples, however, relate to considerable depths in the mass, and not to the immediate surface.

Further, the earths and rocks investigated allow us to express the opinion that the looser earthy coverings of the mound, whether black or red, are freshwater formations. With the exception of No. 5, all the marine forms registered are from points on the shore within high water. No considerable action of the sea upon the soil produced by the grassy vegetation and the uppermost rocks dependent upon this is anywhere indicated by the intermixture of marine forms; consequently the union of the crater-lake with the outer sea, produced since the year 1697, cannot lead us to the conclusion that a rising and swell of the sea touching the upper part of the land has formerly taken place.

The rock No. 5 from the upper margin of the crater (846 ft.) appears to be particularly interesting. It resembles a bog iron-ore, and has been so described by me. From its rich marine organic admixture, it appears to me, in the midst of the freshwater formations, as the ancient sea-bed, which the volcano has forced up, with little change at the time of its elevation, and impregnated with oxide of iron. Perhaps other materials in the collections of the 'Novara' may furnish further evidence, especially as to the thickness of the mass.

It is eight years since I registered, from Kerguelen's Land, situated still further towards the south pole, 56 microscopic

forms, of which 22 species were figured. These investigations were published, in 1854, in the 'Mikrogeologic.' According to this, St. Paul's and Kerguelen's Land have 23 forms in common, namely, 14 Polygastria, 8 Phytolitharia, and 1 Anguillula. In Kerguelen's Land there was one new genus, *Disiphonia*, of which the same species has recently occurred again on Mont Blanc (1859, Monatsber. 779), and a second species in New Zealand (1861, Monatsber. 887). In St. Paul's 5 peculiar genera have been discovered; and it may be worthy of notice that the *Diffugia seminulum*, registered by me from Monte Rosa and the Himalayas, has been brought from St. Paul's in great abundance, together with 9 or 10 other species, some of which are new.

According to the existing indications of its substance as far as they could be tested, the Island of St. Paul does not belong to the lands which were above the water before the last great geological catastrophe; it appears to be a volcanic elevation of a more modern, although prehistoric period. *All the new genera of microscopic independent beings belong to mineral waters and salt water, and not to the land.* The *Lithosemata* are silicious particles of grasses, one of which has been formerly described and figured by me as *Lithostylidium comtum* of the trade-wind dust, and another as *Lithostylidium ornatum*. Traces of quite unknown and peculiar types of organic life, such as are exhibited by New Holland, New Zealand, and Madagascar, are wanting in St. Paul's, even amongst microscopic organisms.

From all the specimens examined, however, it appears that in St. Paul's an abundant, earth-forming, invisibly powerful organic life is going on. Whoever is inclined to regard the invisible as unimportant will leave it unnoticed. For my part, I cannot but regard this newly opened isolated focus of powerfully active minute life with deep interest, and wish much that many travellers may be incited to assist as much as lies in their power in the further elucidation of the great invisible rock- and earth-forming life of Nature. Perhaps the present communication may serve to bring to light certain points of view which may be capable of awakening interest in many ways.

XL.—On the *Archæopteryx lithographica*, from the *Lithographic Slate of Solenhofen*. By HERMANN VON MEYER*.

FEATHERS, or indeed any remains of birds, have hitherto been known in no rock older than the Tertiary period. Reports of greater antiquity have not been confirmed. Either the speci-

* Translated from *Palæontographia*, vol. x. p. 53, by W. S. Dallas, F.L.S.

mens upon which they are founded do not belong to birds, or the formation, if it contained actual remains of birds, has been represented as more ancient than it really was. This applies even to the Glarus slates, which were regarded as Cretaceous at the period when a bird occurred in them, whilst they are only Tertiary. In my investigations of this bird (*Palæontogr.* iv. p. 90), I have repeatedly indicated that the phenomenon known under the name of *Ornithichnites*, attributed to the footprints, traces, or tracks of birds, is but little fitted to decide so important a matter as the antiquity of existence of an entire class of animals. It has been made use of to claim a high antiquity for birds. But Ichnology, or the whole theory of fossil footprints, reposes only upon phenomena of resemblance; and although philosophers of the highest rank are to be found among its defenders, and its literature has acquired great dimensions, it is still destitute of a scientific foundation.

Remains of birds have frequently been supposed to occur in the Lithographic Slate; but it appeared, upon closer investigation, that these were derived from *Pterodactyles*, or from the *Rhamphorhynchi*, which belong to the same group, from the structure of which we cannot well conclude that the animals were clothed with feathers; and no traces of feathers were ever discovered with the numerous *Pterodactyles* found, of some of which the skeletons were perfect. (See my work '*Reptilien aus dem lithographischen Schiefer*,' 1860, p. 21.)

From the circumstance that remains of birds were not to be found in pre-Tertiary formations, and that birds only begin to appear after the extinction of the *Pterodactyles*, which continued to occur up to the Chalk, it has been concluded that the *Pterodactyle* as it were represents the prototype of the bird.

This rendered it the more surprising that recently a feather should be brought to light, and indeed precisely in the same formation, and even at the same spot, which furnishes the greatest number of *Pterodactyles*. This discovery is an event of so much importance in palæontology that it calls for the most thorough investigation. Although I had not the least reason to doubt of the integrity of the source through which the fossil was intrusted to me, still I must admit that it was not without some mistrust that I set about the examination of the subject, which had to be carried out in all directions, and in which the chief object was to answer the following three questions:—

1. Is the rock the Lithographic Slate of the Upper Jurassic series?
2. Is the object upon it a feather such as birds possess?
3. Is the object really petrified, *i. e.* of the same age as the fossils of the Lithographic Slate?

As regards the first question, I can assert that the fossil before me, in its two corresponding slabs, is derived from the quarries of Solenhofen, whence it came to me direct. The stone agrees perfectly with the lithographic slate in fracture, weight, and mass. The colour is that of the ash-grey variety; the cleavage-surfaces are flat and spotted with brown, especially on the slab in which the feather is most distinctly shown. This slab is 0·022 metre, the opposite one 0·016 metre in thickness. The notion that the stone has been artificially prepared is quite inadmissible. On the outer surfaces small Echinoderms of the genus *Saccosoma* are observed, and these may serve to place the age of the stone beyond a doubt.

The second question may also be answered most satisfactorily. The object occurring on the stone agrees in all its parts so perfectly with the feather of a bird, that it is impossible to distinguish it therefrom. The feather is admirably preserved; the extremity of the stem alone is less distinctly exhibited, betraying



a softer consistence of this part, which will be due to the fact that the feather was not completely developed, or that it belonged to a young animal. The entire length of the feather is 0·069 metre, of which 0·054 belongs to the vane, which is truncated at right angles and rounded-off at the extremity, and has a nearly uniform breadth of 0·011 metre; the breadth only diminishes a little towards the truncated extremity. The stem was pretty strong, and measures fully 0·001 metre in thickness. The fibres of which the vane is composed may be distinctly traced; even the small barbles with which they are beset may be recognized. Here and there the vane gapes a little, probably in consequence of pressure upon the original curvature of the feather, which is completely flattened. It is at the same time nearly straight, and the vane on one side is twice as broad as that on the other, in which it resembles a wing or tail quill-feather. The vane is blackish brown, and becomes a little darker towards the extremity, which might be due to the original coloration. This feather is only a little smaller and less rounded or more angular at the extremity of the vane than that of the common Partridge.

Lastly, as regards the third question, I have employed the most careful investigation for its solution, but can only come to the conclusion that the feather is truly fossilized, and of the same age as the Lithographic Slate, to which, therefore, it truly

belongs, like the other fossils occurring therein. The employment of the two corresponding slabs was of great service in these investigations. No notion of the feather being produced by human hands is admissible. No draughtsman could produce anything so real. Nor is there any more room to think that a feather may have been pressed between two slabs of stone, and converted, by some process or other, into an artificial fossil. By careful examination it will be found that, notwithstanding its delicacy, the feather has produced slight impressions in the stone. The stone was therefore not fully hardened at the time of its being deposited. The substance into which the feather has been changed reminds one of the dendritic deposits; but dendritic formations have nothing to do with it. The mode of preservation resembles that of the birds' feathers which I have examined from Tertiary strata, and which I shall shortly publish.

As evidence of the genuineness of the feather, I may also state that upon the same cleavage-surface of the stone many small, fine, blackish fibres, like short hairs, are scattered about; these will likewise be derived from the epidermic covering of the animal. The fibres of the vane acquire a more hairlike aspect towards the quill, and in its immediate vicinity there are also numerous little isolated hairs, or shorter and not plumose filaments.

The genuineness of the feather found in the Lithographic Slate of Solenhofen is consequently not to be doubted.

As early as the year 1834 I indicated the danger to which we expose ourselves in palæontology by drawing logical conclusions in accordance with Cuvier's theory, from the similarity of particular parts as to the similarity of other parts or of the whole. I at the same time showed that, in one and the same creature, the most different types may occur together, purely developed. The fossil feather of Solenhofen, therefore, even if agreeing perfectly with those of our birds, need not necessarily be derived from a bird. And, indeed, a feathered animal, differing essentially from our birds, has occurred in the Lithographic Slate*. My first information about this was received by me, just after the completion of my investigations, from M. Witte of Hanover. This gentleman saw, in the possession of M. Häberlein of Pappenheim, upon a slab of Solenhofen slate, about $1\frac{1}{4}$ square foot in size, an animal of which he remarked that it possessed feathers, and that the feathers of the tail were attached, not, as in birds, to the last vertebra, but on each side of the caudal vertebrae. The feathers were, moreover, quite distinctly furnished with stem and vane. Soon afterwards, Professor Oppel of Munich wrote

* See 'Annals,' April 1862, p. 261.

me to the same effect, he having seen this fossil. The animal, of which the head is wanting, is abundantly endowed with feathers. It possesses a long tail, like *Rhamphorhynchus*, and a small pelvis; like birds, it has a single bone forming the tarsus; it is furnished with three toes; on the anterior limbs there is a fan of feathers, and also on the tail, on which the feathers radiate, not from the last vertebra, but laterally along the vertebræ. The simple tarsus of itself shows that this animal does not belong to the Pterodactyles, and the formation of the tail contradicts the idea that we connect with our birds, yet the feathers are not distinguishable from those of birds. The fossil feather from Solenhofen described by me will be derived from a similar animal, for which I have selected the name of *Archæopteryx lithographica**.

XLI.—*Descriptions of newly discovered Spiders from the Island of Madeira.* By JOHN BLACKWALL, F.L.S.

A COLLECTION of Spiders recently made in the Island of Madeira, and presented to me by the Rev. Hamlet Clark, comprised the following species, which appear to be new or imperfectly known to arachnologists.

Tribe Octonoculina.

Family THOMISIDÆ.

Genus THOMISUS, Walck.

Thomisus spinifer.

Length of the male $\frac{1}{8}$ th of an inch; length of the cephalothorax $\frac{1}{16}$; breadth $\frac{1}{16}$; breadth of the abdomen $\frac{1}{20}$; length of an anterior leg $\frac{1}{4}$; length of a leg of the third pair $\frac{3}{20}$.

The cephalothorax is broad, convex, glossy, slightly compressed before, rounded in front and on the sides, abruptly depressed at the base, provided with a few strong black bristles, those on the frontal margin being directed forwards, and is of a reddish-yellow colour, an obscure band in the middle, which tapers from the eyes to its posterior extremity, being the palest. The eyes, which are seated on whitish spots, are disposed on the anterior part of the cephalothorax in two transverse curved rows, forming a crescent whose convexity is directed forwards; the eyes of each lateral pair are placed on tubercles, those of the anterior row being the largest of the eight. The falcæ are short, cuneiform, and vertical; the maxillæ are obliquely truncated at the extremity on the outer side, and inclined towards the lip, which is triangular; the sternum is heart-shaped; the legs are very un-

* Jahrb. für Mineral. 1861, p. 679.

equal in length, and are provided with hairs and spines; the first and second pairs are much the longest, the first pair rather surpassing the second, and the third pair is the shortest; each tarsus is terminated by two curved pectinated claws. The colour of these parts is pale dull yellow, the lip being the darkest, and the joints of the first and second pairs of legs having a brownish-red hue at the extremity. The palpi are short, and of a pale dull-yellow colour; the radial is rather shorter than the cubital joint, and projects a pointed apophysis from its extremity on the outer side; the digital joint, which is slightly tinged with brown, is convex and hairy externally, concave within, comprising the palpal organs, which are neither highly developed nor complicated in structure; they have a short, curved, black spine at their extremity, on the outer side, and are of a pale brownish-red colour. The abdomen is oviform, somewhat depressed, projects over the base of the cephalothorax, and is supplied on the upper part with fine black spines, more or less erect; a yellowish-brown band, that is palest in the medial line, extends along the upper part from its anterior extremity to the spinners, and is bounded on each side by a yellowish-white band; and a black band passes along each side, whose superior margin is bordered with red; the under part has a whitish-yellow hue, that of the branchial opercula is pale dull yellow, and the colour of the spinners is reddish brown.

Family CINIFLONIDÆ.

Genus CINIFLO, Blackw.

Ciniflo affinis.

Length of the female $\frac{1}{10}$ th of an inch; length of the cephalothorax $\frac{1}{20}$; breadth $\frac{1}{24}$; breadth of the abdomen $\frac{1}{20}$; length of an anterior leg $\frac{1}{8}$; length of a leg of the third pair $\frac{1}{10}$.

The eyes are unequal in size, and are disposed on the anterior part of the cephalothorax in two transverse rows; the four intermediate ones form a trapezoid whose anterior side is the shortest, and those of each lateral pair are seated obliquely on a tubercle, and are near to each other, but not in contact; the lateral eyes of the anterior row, which is situated immediately above the frontal margin, are rather the largest, and the intermediate ones of the same row are the darkest and much the smallest of the eight. The cephalothorax is compressed before, rounded in front and on the sides, which are marked with furrows converging towards the middle; it is convex in the cephalic region, depressed at the base, glossy, and of a yellowish-brown colour, the anterior part and narrow lateral margins being the darkest. The falces are powerful, conical, and vertical; the maxillæ are somewhat

enlarged at the extremity, and slightly inclined towards the lip, which has a short-oval form; the sternum is heart-shaped; the legs are moderately long, provided with hairs and fine spines, and each posterior one has a calamistrum on the superior surface of its metatarsus; the first pair is the longest, the second and fourth pairs are about equal in length, and the third pair is the shortest. These parts, with the palpi, are of a brownish-yellow colour, the annuli with which the legs are marked and the base of the lip having a brown-black hue. The abdomen is oviform, sparingly clothed with hairs, convex above, and projects over the base of the cephalothorax; the upper part is of a dull yellowish-brown hue, spotted with white; at the anterior part there is a brownish-black oblong mark, tinged with dull yellow in the medial line, which is followed by four black spots, disposed in pairs, and inclined towards each other; to these succeed several angular lines of the same hue, whose vertices are directed forwards; the sides have a dull-brown hue, the superior margin being the darkest, and the colour of the under part is pale yellowish brown; the sexual organs are moderately developed, and of a red-brown colour; the spinners are eight in number, and those of the inferior pair, which are the shortest, consist of a single joint each, and are united throughout their entire length.

This minute species is very closely allied to *Ciniflo humilis*.

Genus VELEDA, Blackw.

Veleda pallens.

Length of the male $\frac{1}{8}$ th of an inch; length of the cephalothorax $\frac{1}{20}$; breadth $\frac{1}{24}$; breadth of the abdomen $\frac{1}{20}$; length of an anterior leg $\frac{1}{6}$; length of a leg of the third pair $\frac{1}{12}$.

The legs are very unequal in length; the first pair is much the longest, then the fourth, and the third pair is the shortest; each metatarsus of the posterior pair is provided with a calamistrum situated on its superior surface, and on the inferior surface of its extremity and that of the tarsus there are some short spines; the colour of these limbs, which are hairy, is brownish yellow, a dark-brown line extending along the upper part of the femora, genua, and tibiæ of the second, third, and fourth pairs; the femora, genua, tibiæ, and base of the metatarsus of the first pair have a dark-brown hue, that of their sides being yellow-brown. The palpi resemble the third pair of legs in colour, but the specimen from which the description was made had to undergo its final ecdysis; for though the digital joints were very tumid, yet the palpal organs were not developed. The cephalothorax is long, somewhat compressed before, depressed and rounded on the sides, clothed with white hairs, and has an

indentation in the medial line; it is of a brownish-black colour, with three longitudinal yellowish-white bands, one in the middle, another on each side, and with lateral margins of the same hue. The eyes are small, nearly equal in size, and disposed on the anterior part of the cephalothorax in two transverse curved rows, whose convexity is directed forwards; the anterior row, which is the less curved, is situated near the frontal margin, and the intermediate eyes, which are seated on a tubercle, are the largest, and the lateral ones rather the smallest of the eight; the lateral eyes of both rows are widely apart, and are placed on minute tubercles, and the intermediate ones form a trapezoid whose anterior side is the shortest. The falcæ are short, conical, vertical, and of a yellowish-brown colour. The maxillæ are straight, powerful, and greatly enlarged and rounded at the extremity, which is rather prominent on the inner surface; and the lip is short and triangular. These organs are of a reddish-brown colour. The sternum is of an oblong-oval form; it is thinly clothed with white hairs, and has a brownish-black hue. The abdomen is of an oblong-oviform figure, somewhat convex above, and projects over the base of the cephalothorax; the upper part is of a yellowish-white colour, finely reticulated with brown; a narrow dark-brown band extends along the middle, which is broadest towards its anterior extremity, and is crossed by several very short lines of the same hue near the spinners, and from these organs two short, dark-brown, lateral streaks are directed forwards; the sides are minutely spotted with brown, and a broad brownish-black band, bordered by dull white, extends along the middle of the under part; the spinners are eight in number, those of the inferior pair, which are the shortest, consist of a single joint each, and are united throughout their entire length.

That the *Veledæ* evidently possess many well-marked characters in common with the spiders of the genus *Uloborus* is asserted in the 'History of the Spiders of Great Britain and Ireland,' part 1. p. 151; but as MM. Dufour, Hahn, and Koch affirm that the snare of *Uloborus Walckenaerius* is constructed on the same plan as those of the *Epeiridæ*, it may be inferred that it has not the additional pair of spinners and calamistra, as the snares of all spiders provided with this apparatus, whose economy is known, exhibit unmistakeable evidence of its having been employed in their fabrication.

Genus MITHRAS, Koch.

Mithras flavidus.

Length of the male $\frac{1}{10}$ th of an inch; length of the cephalo-
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thorax $\frac{1}{18}$; breadth $\frac{1}{18}$; breadth of the abdomen $\frac{1}{18}$; length of an anterior leg $\frac{1}{5}$; length of a leg of the third pair $\frac{1}{12}$.

The cephalothorax has a short, broad, somewhat oval form; it is convex, prominent and rather pointed in front, depressed at the base, and has two furrows on each side directed obliquely upwards; it is clothed with short yellowish-white hairs, and its colour is yellowish brown, the medial line and anterior margin being the palest. The eyes, which are very unequal in size, and seated on brown spots, are disposed on the sides and anterior part of the cephalothorax in two transverse curved rows; those of the posterior row, which is much the longer, and has its convexity directed forwards, are much larger than those of the anterior row, the lateral eyes, seated on bold conical tubercles, being rather the largest; the eyes of the anterior row, whose convexity is directed upwards, are situated high above the frontal margin, the two intermediate ones are placed very near to each other on a minute tubercle, and the lateral ones are not very conspicuous, being the smallest and lightest-coloured of the eight; the lateral eyes of both rows are separated by a very wide interval. The falces are short, subconical, and vertical; the maxillæ are powerful, and greatly enlarged at the extremity, which is protuberant on the inner surface; the lip is triangular, and the sternum is oblong heart-shaped, with small eminences on the sides opposite to the legs. These parts are of a dull brownish-yellow colour, the sternum, which is the darkest, having its extremity and lateral margins of a dark-brown hue. The legs are very unequal in length, the first pair being much the longest and most robust; the second pair is longer than the fourth, and the third pair is the shortest; they are provided with hairs and sessile spines, the latter being the longest and most numerous near the base of the tibia of the anterior pair on the inner side, and a calamistrum occurs on the upper surface of the metatarsus of each posterior leg; these limbs have a dull brownish-yellow hue, and, with the exception of the tarsi, are more or less marked with dark brown on the inner surface. The palpi resemble the legs in colour, but are not marked with dark brown; the humeral joint is slightly curved upwards; and the radial, which is longer than the cubital joint, is oval, and supplied with some long bristles at its pointed extremity; the digital joint is large, of an oblong-oval form, convex and clothed with coarse hairs externally, and concave within; connected with this concavity are the very highly developed and complex palpal organs, whose broad prominent base, though curved abruptly downwards, extends to the articulation of the humeral with the cubital joint; a remarkably long, black, filiform spine passes under their margin along the inner side, and curves round the

extremity, outer side, and base; they are terminated by several curved pointed processes, and have a yellowish-red hue, that of the margins being brown. The abdomen is oviform, convex above, with a conical protuberance on the upper part of each side, which is nearly equidistant from both extremities; it is densely clothed with coarse hairs, and projects over the base of the cephalothorax; its colour is dull yellow, with a brown band extending along the middle of the upper part, which tapers to the spinners, and is somewhat ramified; the lateral protuberances have a faint tinge of orange, and the sides are marked with oblique, slightly curved, dark-brown lines; the under part has a dark-brown hue mingled with dull yellow, and is broadly bordered laterally with yellowish white: the spinners are eight in number; those constituting the inferior pair, which are the shortest, consist of a single joint each, and are united throughout their entire length.

Arachnologists have experienced much difficulty in assigning to *Mithras paradoxus*, the type of the genus, a satisfactory position in the systematic arrangement of the *Araneidea*; nor is this at all surprising, as its appearance is very anomalous, and long after its discovery it was generally supposed to have only six eyes. It is now known to possess eight organs of vision; and if, as is in the highest degree probable, it and the *Mithras undulatus* of M. Koch should be found to have four pairs of spinners and calamistra, every difficulty with regard to their classification will be removed; for in that case they, together with *Mithras flavidus* and *Mithras dubius*, must undoubtedly be placed in the family *Ciniflonidæ*, immediately after the genus *Veleda*.

Mithras dubius.

Length of the female $\frac{1}{10}$ th of an inch; length of the cephalothorax $\frac{1}{20}$; breadth $\frac{1}{24}$; breadth of the abdomen $\frac{1}{16}$; length of an anterior leg $\frac{1}{7}$; length of a leg of the third pair $\frac{1}{10}$.

The cephalothorax is short, broad, somewhat oval, convex, but depressed at the base, prominent and rounded in front, and has two furrows on each side directed obliquely upwards; it is thinly clothed with short yellowish hairs, and of a dark-brown colour, being palest in the medial line and immediately above the lateral margins. In the disposition and relative size of its eyes it resembles *Mithras flavidus*. The falces are short, subconical, and vertical; the maxillæ are powerful and greatly enlarged at the extremity, which is protuberant on the inner surface; the lip is triangular, and the sternum is oblong heart-shaped, with small eminences on the sides opposite to the legs. These parts are of a dull brownish-yellow colour, the sternum, which is the darkest, having its extremity and lateral margins of a dark-brown hue.

The legs are robust, provided with hairs and a few fine spines, and there is a calamistrum on the upper surface of the metatarsus of each posterior leg, they are very unequal in length, the first pair being much the longest, the second pair surpasses the fourth, and the third pair is the shortest; they have a dull brownish-yellow hue, and, with the exception of the tarsi, are marked with very dark brown on the inner surface. The palpi are short, and resemble the legs in colour. The abdomen is somewhat oviform, convex above, projecting over the base of the cephalothorax, and has a prominent conical protuberance on the upper part of each side, which is nearly equidistant from both extremities; the upper part is of a brown colour, bordered by a pale-yellow band, whose continuity is interrupted in front; the medial region has a dull brownish-yellow hue, and comprises in its anterior part a brown streak, which extends about one-third of its length; the brown upper part is intersected by brownish-black transverse lines; those on the anterior half have their extremities enlarged, more especially that which connects the two conical protuberances, and those on the posterior half form very obtuse angles whose vertices are directed forwards; the sides are marked with oblique, confluent, dark-brown lines, and the under part has a dark-brown hue slightly mixed with dull brownish yellow, and is broadly bordered laterally with yellowish white; the eight spinners have a brownish-yellow hue; those of the inferior pair, which are the shortest, consist of a single joint each, and are united throughout their entire length.

The specific name *dubius* is conferred provisionally upon this spider, as it possibly may be the female of *Mithras flavidus*, though it differs from it greatly in colour.

Family THERIDIIDÆ.

Genus THERIDION, Walck.

Theridion elegans.

Length of the female $\frac{3}{10}$ ths of an inch; length of the cephalothorax $\frac{1}{10}$; breadth $\frac{1}{10}$; breadth of the abdomen $\frac{1}{12}$; length of an anterior leg $\frac{1}{4}$; length of a leg of the third pair $\frac{1}{6}$.

The legs are moderately long, provided with hairs, and of a reddish-yellow hue, with dark-brown annuli at the extremity of the joints, those of the femora being the broadest; the first pair is the longest, the second and fourth pairs are about equal in length, and the third pair is the shortest; each tarsus is terminated by three claws; the two superior ones are curved, and the inferior one is inflected near its base. The palpi resemble the legs in colour, but are rather paler, and have a curved claw at their extremity. The cephalothorax is convex, glossy, somewhat

compressed before, rounded on the sides, which are marked with slight furrows converging towards an indentation in the medial line, and is of a dark-reddish-brown colour, the medial line and lateral margins being much the darkest. The eyes are nearly equal in size, and are disposed on the anterior part of the cephalothorax in two transverse rows; the four intermediate ones form a square, the anterior ones, which are seated on a slight prominence, being the darkest of the eight; and those of each lateral pair are placed obliquely on a tubercle, and are contiguous. The falces are conical, vertical, and armed with a few small teeth near their extremity on the inner surface; the maxillæ are obliquely truncated at the extremity, on the outer side, and are inclined towards the lip, which is triangular. These organs are of a red-brown colour, the base of the lip, a longitudinal streak on the outer side of the falces, and a spot near their base, in front, having a dark-brown hue. The sternum is heart-shaped, with eminences on the sides opposite to the legs, and is of a dark-brown colour, tinged red in the medial line. The abdomen is somewhat oviform, sparingly supplied with hairs, very convex above, and projects over the base of the cephalothorax; the upper part is of a yellowish-white colour, obscurely reticulated with fine pale-brown lines, and a dark-brown, dentated, medial band tapers to the spinners, whose continuity is interrupted near its anterior extremity, which is the darkest; the sides have a brown hue, being darkest at their superior margin, and are marked with oblique lines formed by confluent dull yellowish-white spots; a dark-brown band, which is broadest at its posterior extremity, extends along the middle of the under part, and two short streaks of the same hue pass outwards from each side of the spinners; the medial band is bordered laterally with yellowish white, and the colour of the sexual organs is reddish brown.

The sexes resemble each other in the design formed by the distribution of their colours; but the male is smaller than the female, and the relative length of its legs is different, the second pair being very decidedly longer than the fourth. Its palpi are short, and of a pale-yellowish colour, the digital joint having a tinge of brown; several long bristles project from the cubital joint in front, and the radial joint has two apophyses at its extremity, one on the inner and the other on the outer side, the superior margin of the latter, which is the larger, being fringed with long hairs extending over the palpal organs; the digital joint has a short, broad, somewhat oval form, its superior margin being much the most curved; it is convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, encircled by two contiguous, filiform, black spines,

and are of a pale-brownish-yellow colour. The convex sides of the digital joints are directed towards each other.

Family LINYPHIIDÆ.

Genus NERIENE, Blackw.

Neriene pigra.

Length of the female $\frac{1}{9}$ th of an inch; length of the cephalothorax $\frac{1}{20}$; breadth $\frac{1}{24}$; breadth of the abdomen $\frac{1}{16}$; length of an anterior leg $\frac{1}{6}$; length of a leg of the third pair $\frac{1}{9}$.

The eyes are disposed in two transverse rows on the anterior part of the cephalothorax; the four intermediate ones form a trapezoid, the two anterior ones, which constitute its shortest side, being the smallest of the eight; the eyes of each lateral pair are seated obliquely on a tubercle, and are near to each other, but not in contact. The cephalothorax is convex in the cephalic region, glossy, somewhat compressed before, rounded in front and on the sides, which are marked with slight furrows converging towards an indentation in the medial line; the lip is semicircular and prominent at the apex; and the sternum is heart-shaped. These parts are of a brown colour, the sternum and base of the lip being much the darkest. The falces are powerful, conical, rather divergent at the extremity, inclined towards the sternum, armed with teeth on the inner surface, and have a longitudinal row of short strong spines in front, towards the outer side; the maxillæ are somewhat enlarged at the extremity, and inclined towards the lip; the legs are moderately long, and provided with hairs; the first pair is the longest, then the fourth, and the third pair is the shortest; each tarsus is terminated by three slender claws; the two superior ones are curved, and the inferior one is inflected at its base; the palpi are slender and without a claw at their extremity. These organs have a yellow-brown hue, the legs and palpi being much the palest. The abdomen is subglobular, thinly clothed with short hairs, glossy, and projects over the base of the cephalothorax; it is of a brownish-black colour, and that of the sexual organs, which have, in connexion with their anterior margin, an oval process directed backwards, is dark brown faintly tinged with red.

Family EPEIRIDÆ.

Genus EPEIRA, Walck.

Epeira lentiginosa.

Length of the female $\frac{5}{24}$ ths of an inch; length of the cephalothorax $\frac{1}{8}$; breadth $\frac{1}{12}$; breadth of the abdomen $\frac{1}{8}$; length of an anterior leg $\frac{7}{16}$; length of a leg of the third pair $\frac{1}{4}$.

The abdomen is short, broad, somewhat triangular, having its vertex at the spinners, convex above, thinly clothed with pale hairs, and projects greatly over the base of the cephalothorax; the upper part is of a dark soot-colour, thickly freckled with yellowish white, particularly at the anterior extremity; the sides and under part have a yellow-brown hue; the former are marked with oblique, dark, soot-coloured lines, and the latter has a broad longitudinal band of the same hue in the middle, on each side of which there is a curved yellow line, whose posterior extremity is the broadest; and the colour of the spinners is dark-brown. The sexual organs of the specimen from which the description was made were not fully developed; consequently it had not arrived at maturity. The cephalothorax is convex, glossy, compressed before, rounded on the sides, which are marked with slight furrows converging towards an indentation in the medial line; it has a dull-yellow hue, and from the anterior margin, which is soot-coloured, a short broad streak of the same hue passes upwards between each lateral pair of eyes and the intermediate ones. The eyes are seated on black spots on the anterior part of the cephalothorax; the four intermediate ones, which are placed on a prominence, form a square nearly, those of the anterior pair being rather wider apart than those of the posterior pair, and the eyes of each lateral pair are seated obliquely on a tubercle, and are the smallest of the eight. The falcæ are conical, vertical, and armed with teeth on the inner surface; the maxillæ are short, straight, powerful, and enlarged and rounded at the extremity; the lip is semicircular, but somewhat pointed at the apex, and the legs are long, robust, and provided with hairs and spines; the first pair is the longest, then the second, and the third pair is the shortest; each tarsus is terminated by claws of the usual number and structure. These parts have a dull-yellow hue, but the base of the lip is soot-coloured, and annuli of the same hue occur on the legs, those at the extremity of the femora of the posterior pair being the broadest. The palpi resemble the legs in colour, and have a curved minutely pectinated claw at their extremity. The sternum is heart-shaped, with eminences on the sides opposite to the legs; it is of a dark brown colour, strongly tinged with yellow in the medial line.

Genus TETRAGNATHA, Latr.

Tetragnatha lineata.

Length of the male $\frac{1}{7}$ th of an inch; length of the cephalothorax $\frac{1}{16}$; breadth $\frac{1}{24}$; breadth of the abdomen $\frac{1}{16}$; length of an anterior leg $\frac{7}{16}$; length of a leg of the third pair $\frac{1}{4}$.

The eyes, which are unequal in size, and seated on black

spots, are disposed on the anterior part of the cephalothorax in two transverse rows; the four intermediate ones form a trapezoid whose anterior side is the shortest, those of the anterior pair are placed on a small tubercle, and those of the posterior pair, which are much the largest of the eight, are placed on separate tubercles; the eyes of each lateral pair are the smallest, and are seated near to each other, but not in contact, on a minute tubercle. The cephalothorax is moderately convex, glossy, compressed before, rounded in front and on the sides, which are marked with slight furrows converging towards an indentation in the medial line; it is of a dull-yellow colour, with a brownish-black longitudinal band in the middle, and a less distinctly defined one of the same hue above each lateral margin. The falcæ are long, conical, rather divergent at the extremity, armed with teeth on the inner surface, and inclined towards the sternum; and the maxillæ are straight and enlarged and somewhat rounded at the extremity. These organs have a dull-yellow colour, faintly tinged with brown. The lip is nearly semicircular, but pointed and prominent at the apex; and the sternum is heart-shaped. These parts have a reddish-brown hue, the lip being much the darkest. The legs are long, very slender, provided with hairs and a few spines, and are of a dull-yellow hue, with brown-black annuli at the extremity of the joints; the first pair is the longest, then the second, and the third pair is the shortest; the tarsi are terminated by claws of the usual number and structure. The palpi are short, paler than the legs, and without brown-black annuli; the radial is larger than the cubital joint, and has a long bristle at its extremity, in front; the digital joint is oval, convex and hairy externally, concave within, comprising the palpal organs, which are moderately developed, rather complex in structure, with a long, prominent, dark-brown, filiform spine, that originates near their extremity on the inner side, and curves obliquely upwards to the outer side; these organs have a brownish-red hue. The convex sides of the digital joints are directed towards each other. The abdomen is long, subcylindrical, or somewhat depressed, and projects a little over the base of the cephalothorax; it is glossy, of a pale dull-yellowish colour, and has a black band extending along the middle of the upper part about two-thirds of its length; this band, which has numerous white spots on each side of it, is bifid at its posterior extremity, and is succeeded by several angular lines of the same hue, whose vertices are directed forwards; and a black line, slightly varying in breadth, passes along the upper part of each side, the two meeting above the spinners; a broad, dark-brown, longitudinal band occurs in the middle of the under part, and the colour of the branchial opercula is pale yellow.

Tribe Senoculina.

Family DYSDERIDÆ.

Genus DYSDERA, Latr.

Dysdera diversa.

Length of the male $\frac{5}{10}$ ths of an inch; length of the cephalothorax $\frac{1}{7}$; breadth $\frac{1}{9}$; breadth of the abdomen $\frac{1}{9}$; length of an anterior leg $\frac{3}{8}$; length of a leg of the third pair $\frac{3}{10}$.

The cephalothorax is convex, slightly compressed before, rounded on the sides and in front, without an indentation in the medial line, and is of a very dark-brown colour, faintly tinged with red. The eyes, which are nearly equal in size and diaphanous, are closely grouped in the form of a small oval open in front, on a prominence of the cephalothorax, situated immediately above the frontal margin, the two anterior ones being rather the largest of the six. The falcæ are subconical, prominent, armed with a few small teeth, and fringed with long hairs on the inner surface; the maxillæ are straight, enlarged and convex at the base, and somewhat pointed at the extremity, which is rather protuberant on the inner side; the lip has an oblong-oval form, decreasing in breadth to the apex, which is notched, and has a transverse furrow at its base; and the sternum is oval. These parts are of a red-brown colour, the sternum being the darkest, and the maxillæ and apex of the lip the palest. The legs are moderately long, provided with short hairs, and have a red hue; the third and fourth pairs are rather the palest, and have a few sessile spines on the tibia, metatarsus, and tarsus; the first pair is the longest, then the second, and the third pair is the shortest; each tarsus is terminated by two curved, minutely pectinated claws, and below them there is a small scopula. The palpi resemble the legs in colour; the digital joint is small, oval, convex and hairy externally, slightly concave underneath, and with this concavity the palpal organs are connected by a short pedicle; they are prominent, directed upwards, not very complex in structure, oviform at the base, from which a long, curved, somewhat depressed process extends, whose extremity appears to be bifid, but its dark-brown divergent branches are connected by pale delicate membrane; these organs, which have a small, slightly curved, dark-brown process near their middle, on the under side, are of a pale-yellowish-red hue, with two transverse brownish-red bands at their oviform base, formed apparently by the convolutions of an internal vessel. The abdomen is oviform, thinly clothed with short hairs, convex above, and projects a little over the base of the cephalothorax; it is of a very pale-yellow colour, reticulated with brown on the upper part, a short longitudinal line of the latter hue occurring

in the middle, and near the anterior extremity there is a minute circular depression on each side of the medial line; the under part is rather the palest, and has a branchial and tracheal stigma on each side of its anterior extremity.

Family ŒCOBIIDÆ.

Genus ŒCOBIUS, Lucas.

Œcobius navus.

Œcobius navus, Blackw. Ann. & Mag. Nat. Hist. ser. 3. vol. iv. p. 266.^a

Several specimens of *Œcobius navus* were comprised in the collection of Madeiran Spiders presented to me by the Rev. Hamlet Clark, and among them an adult female, a careful examination of which has led to the establishment of important characters either previously unrecorded or regarded as doubtful.

The dimensions of this species, as given in the 'Annals and Mag. of Nat. Hist.,' do not require any correction. Its legs are equal in length, and the posterior pair have a calamistrum on the superior surface of each metatarsus. The spinners are eight in number; those constituting the inferior pair, which are the shortest, consist of a single joint each, and are united throughout their entire length. The sexual organs are moderately developed, of a red-brown hue, and have, in connexion with their anterior margin, a brownish-yellow process which is directed backwards.

This is the only Spider provided with eight spinners and calamistra, belonging to the tribe *Senoculina*, that has come under my observation; and as its superior spinners are long and triarticulate, with the spinning-tubes disposed on the inferior surface of their terminal joint, it may reasonably be inferred that its economy must be influenced by its very remarkable external structure.

From the above considerations, it is evident that for the reception of this species, and also of the *Œcobius domesticus* and *Œcobius annulatus* of M. Lucas, should a close relation of affinity be hereafter established among them by similarity of organization, of which scarcely a doubt can be entertained, a new family must be founded, which may be thus characterized:—

Family ŒCOBIIDÆ.

Spinners eight; those of the inferior pair, which are the shortest, consist of a single joint each, and are united throughout their entire length.

Legs of variable relative length in different species, each metatarsus of the posterior pair being provided with a calamistrum on its superior surface.

XLII.—On some new Thalassinæ sent from the Philippines by M. Jagor, and on the Systematic Position of that Family. By Dr. STRAHL*.

Scytoteptus serripes, Gerstäcker.

THIS genus and the single species known to belong to it were established by Gerstäcker from a single mature female specimen. This specimen is from South Africa. M. Jagor has sent a male specimen of this species from Luzon, together with other *Thalassinæ* and *Alpheï*. The Zoological Museum of Berlin possesses four more *Scytotepti* brought from Mozambique by Prof. Peters; these also belong to the same species, and two of them are male and two female. From these materials it becomes possible to obtain a more accurate notion of the organization of this genus.

The male individuals are smaller than the females. The cephalothorax of the male from Luzon measures 5 lines (Paris†) in length, the abdomen 10·5 lines, and the tail-fin 2 lines; this gives a total length of 17·5 lines. One of the males from Mozambique has the cephalothorax 8 lines, the abdomen 7, and the tail-fin 3 lines in length, giving a total length of 18 lines; whilst the largest mature females measure more than 2 inches up to nearly $2\frac{1}{2}$ inches in length. The tail-fin is always very long; in one female from Mozambique it is 5 lines in length, whilst the abdomen measures 11 lines. The chelæ of the first pair are unequal in this genus, the right one being usually the stronger; in a male from Mozambique this character is, however, reversed. The fifth pair of feet has no branchiæ; the branchiæ on the others are leaflike.

Callianassa mucronata, n. sp.

Of this species I have unfortunately only one specimen at my disposal; and this is a female, of the maturity of which I am not sure, as there were no eggs under its abdomen. From the extreme projecting point of the forehead to the apex of the tail it measures 13 lines. Although it may be a young state, still it shows such differences that it is certainly a new species. Above all things, the forehead is furnished with a small point projecting between the eye-peduncles to about half the length of the latter. This frontal point is smooth above, and not compressed at the sides. On account of this frontal point, which does not occur in any other known *Callianassa*, I have named the species *mucronata*.

The eye-peduncles are, as usual in the *Callianassæ*, vertically

* From the Monatsbericht der Berl. Akad. December 1861, p. 1055. Translated by W. S. Dallas, F.L.S.

† Throughout this paper the measurements are in Paris lines.

compressed; they run out into a point in front, and bear on the outside the convex and pigmented cornea. The eye-peduncles are of the same length as the first joint of the inner antenna, of which the third joint is as large as the first and second together. The two flagella of these antennæ are nearly of equal length: the external one is obliquely truncated in front, and somewhat bent outwards; on its inside it is furnished with a row of long hairs. The inner flagellum is, as usual, about half as long as the thorax of the animal, and internally fringed with long hairs.

The external antenna bears only a single flagellum; this is nearly twice the length of the thorax. The tuberculum occurs quite on the outer side of its joint, as usual in the genus *Callianassa*. The question whether *Callianassa* does or does not possess anything of the nature of an antennal scale is a peculiar and difficult one. A scale covering a larger or smaller portion of the peduncle of the antenna from above certainly does not occur; and yet the peduncle of the antenna is not three-jointed, but contains more joints. In order to understand this matter, it is necessary to examine more closely than has hitherto been usual into the structure of the antennæ, and especially of the outer pair.

I have already shown that the entire group of the Decapoda are divided into two great sections, according as there is at the base of the external antenna an operculum or a half-ring with the tuberculum. In the *tubercular* Decapods this half-ring is attached to the cephalothorax by means of a hinge-joint, and is slightly moveable. The articulation is effected externally to the carapace, and internally to the outer side of the frontal process of the epistomium. This half-ring, which we will call the *intercalare*, is interpolated into the attachment of the antenna to the cephalothorax: it is immediately followed by a joint, which is the common supporter of the antenna and of the scale, and which I call the *armiger*; this bears the scale externally and the antenna internally, and often possesses a spine, as, for example, in the Lobster and the Cray-fish. In the Lobster, just after its escape from the egg, according to the careful observations of Kröyer, the scale-apparatus and antenna are suspended from a single common ring, but are separate*; the latter is certainly the *intercalare*, although Kröyer does not mention that it bears the tuberculum on its ventral surface. In the Cray-fish, at the same period, the scale-joints and the antennal joints are, as I have noticed, more closely approximated; but it has the *intercalare*, and, even several days before exclusion, a distinct tuberculum. Kröyer calls this piece *pars basilaris*, evidently following Milne-Edwards, who, however, uses the term *article basilaire*, without

* Hippolyte's Nordiske Acta, p. 43, taf. 6. fig. 134.

distinction, sometimes for this piece, sometimes for the first joint of the antenna, and sometimes for parts anchylosed to the latter. For this reason I thought it better not to employ this otherwise suitable word. The structures referable to the scale, or the external branch, according to Kröyer's terminology, consist, according to him, in the embryo Lobster, of two joints, of which that placed nearest to the body is, in my opinion, the *armiger*, whilst the extreme one becomes the scale. At a subsequent period the armiger must approach nearer to the antenna and receive the articulation of the first two antennal joints. In the mature Lobster, at least, the armiger is not a complete ring, but is obliquely cut off on the inside, and open there for the purpose of receiving the articulation of the first two antennal joints; the articulation with the intercalare lies in a direction from above downwards, that is, from the dorsal surface towards the ventral surface; the upper articulation is effected upon the carapace, the lower or ventral one on the anterior margin of the intercalare. The articulating axes of the intercalare and armiger therefore cut each other at a right angle, whilst the articulating axis of the scale lies in the same direction as that of the armiger. The first antennal joint is, then, articulated partly on the intercalare and partly on the armiger. The articulating axis in question is directed from within outwards, and therefore at a right angle to the axis of the articulation between the intercalare and armiger, but in an oblique direction from behind forwards, in such a manner that the inner and posterior condyle articulates with the intercalare, and the outer and anterior one at a considerable distance forwards upon the ventral face of the armiger, near the articulation of the scale. The second antennal joint is articulated both to the first joint and to the armiger; the articulating axis is directed from within outwards; the inner condyle is articulated to the anterior inner angle of the first joint, the outer one to the ventral anterior margin of the armiger, where it is received by a pit, which is situated quite close to the ventral articulation of the scale. This inner condyle is often so peculiarly marked, forming as it were a particular dilatation of the second antennal joint, that it frequently appears to be a separate articulated portion of the skeleton. One is led to this erroneous supposition especially when a true scale is wanting; this piece is then easily mistaken for an aborted scale. This is the case in *Callianassa* (with Leach's *C. subterranea* and the species here described), in *Thalassina scorpionoides*, and in Bell's genus *Calocaris*. In the latter the armiger bears externally an acute spine, whilst in the two *Callianassæ* and in the *Thalassinæ* it is unarmed.

The scale-apparatus in the *Thalassinæ* may therefore be so far

aborted that the scale becomes small and inconspicuous (*Glaucothoë*, *Axius*) (?), but it may also entirely lose the scale, when the armiger alone makes its appearance. In *Lithodes arctica*, also, which, however, does not belong to this group, it may be mentioned in passing, only the armiger exists.

To complete the account of the relations of the individual antennal joints, I will add here that the articulating axis of the third joint is again directed from above downwards, and therefore cuts that of the second antennal joint at a right angle. This relation of the articulating axes also occurs elsewhere: for example, in the chelæ of *Lupa*, *Platycarcinus*, &c., the articulating axes between the *brachium*, *carpus*, and *manus* each form a right angle with that of the next joint. But a peculiarity of the articulations of the antennæ is, that on the bent side, in the soft chitinous tissue of the joint close to the sinew of the flexor muscles, there is a sac, into which it is probable that a portion of the articular skin folds itself during flexure. This character is important in determining whether a joint belongs to the antenna or the flagellum. My investigations in this direction show that both the outer and inner antennæ always consist of three joints, as has already been asserted by Krøyer as a result of the embryology. Accordingly the outer antennæ of the *Scyllaridæ* is by no means four-jointed, as is generally supposed; it is only three-jointed, as in the allied *Palinuridæ*. The joint supposed to be the fourth joint does not exhibit the peculiar articulation of an antennal joint, and is therefore a flagellar joint. The *Palinuridæ*, consequently, have a many-jointed flagellum on the outer antenna; the *Scyllaridæ* a one-jointed flagellum only.

The joints of the antennæ of *Callianassa mucronata* are not all of equal length; the first joint is the shortest; the second and third are each nearly twice as long.

The external maxillipeds are opercular, without palpi. The first pair of feet is torn away; the second is didactyle. The last joints of the posterior ambulatory feet are beset with strong stiff hairs more abundantly than in *C. uncinata*. The abdomen exhibits no peculiarities; the central tail-fin is rectangular, broader than long; the lateral appendages, on the contrary, are longer, and form a wide-spread fan. The abdominal feet resemble those of *C. uncinata*.

In company with the specimens just described there is a smaller one, about 5 lines in length, the characteristic frontal point of which shows that it belongs to the same species. It possesses the first pair of feet; and from this we may fill up the gap. This pair of feet bears chelæ, and is the strongest of all; the left foot is stronger than the right one. The hand is hairy,

but the brachium is smooth, slender, and destitute of hooks at its inferior sharp margin. The fingers are acute, about as long as the hand, which is nowhere granular or tubercular. The margin of the fingers is finely denticulated at the base.

Axius plectrorhynchus, n. sp.

The only species of this genus hitherto known, *Axius stirrhynchus*, is European: the species now to be described has been sent from Luzon by M. Jagor: it is represented, unfortunately, only by a single female specimen; but this is sexually mature. It measures about 9 lines in length.

The cephalothorax is laterally compressed and quite unarmed; it has posteriorly an emargination for the reception of the abdomen; on each side of this emargination there is a small process for the reception of the articulation of the first abdominal segment; the frontal rostrum, which is not laterally compressed, is not acute, but terminates in two small points, which lie close together side by side, and are a little turned up in front; the two lateral margins of this process, which gradually approach anteriorly, are each armed with four similar, small, slightly turned-up points (the apical points being included). On each side, near the frontal process, there is a similar spine, which projects in the middle above the eye-peduncle. In the middle of the base of the frontal process, at the commencement of the stomachal region, there stands another equally small and similarly formed spine; so that the forehead bears eleven spines in all.

The eye-peduncles are cylindrical and but small, not reaching quite to the apex of the frontal rostrum; a little before the commencement of the cornea they are somewhat constricted, and then swell out again into a globular form, as in *Gebia littoralis*.

The inner antennæ are cylindrical, and have two flagella; the junction of the second and third joints reaches to the apex of the rostrum; the first joint is the longest, as long as the second and third together. The anterior extremities of the joints are beset with a few hairs. The two flagella are nearly of equal length, about half as long as the carapace. The external antenna has only one flagellum, which is about as long as the carapace. The tuberculum is placed about in the middle of its proper piece. The first antennal joint is the shortest of the three; it bears a spine on the inside in front, and reaches as far forwards as the piece which lies on the outside of it, the armiger, which emits forwards and outwards, near the second joint of the antenna, two horizontal approximated points, of which the inner may perhaps be the scale: from the smallness of the object, and the necessity of handling the unique specimen with care, I found

it impossible to decide whether this inner point is moveable. It is probable that the inner point is moveable, but the outer one is not; consequently the outer point belongs to the armiger, but the inner may be the true scale. Both points, however, are of equal length; the inner one retains the same width for about two-thirds of its length, then narrows, gradually becoming round, and runs on in its last third into a fine point; the outer one, on the contrary, runs gradually and uniformly to a point. The second antennal joint is the longest, and projects a little beyond the two points just mentioned. The outer maxillipeds are foot-like; close to them externally is a palpus with a long flagellum. The branchiæ are in tufts, but the fifth pair of feet bears no branchiæ.

Of the two pairs of chelæ the first is the strongest, and the two legs are of equal length and strength. The hands are laterally compressed, with the upper and lower margins rounded off; the fingers are acute, half as long as the hand; the carpus is triangular, that is to say, the anterior and posterior (articular) margins meet below in an obtuse angle; the upper margin, or third side, however, is not straight, but convex superiorly. The second pair of chelæ is of about the strength of the posterior ambulatory feet; the hand, including the fingers, is of the same length as the carpus; the latter is broader in front than behind. The fifth pair of feet is thinner than the third and fourth. The claw-joint is of the same strength as the rest.

The abdomen, like all the rest of the body and its members, is quite smooth and naked; the tufts of hair on the sides of the abdominal segments, which distinguish *Axius stirhynchus*, are wanting. The lateral appendages of the abdominal segments are but short. The first segment is narrow; the segments gradually increase in length up to the sixth: the caudal scale, again, is smaller, broadly truncated behind; the lateral appendages belonging to it, especially the outer ones, are long. When these parts of the tail-fin are spread out like a fan, their outline is the same as that of the caudal scale. The abdominal appendages on the first segment are simple; the following ones consist of a basal joint, from which two broad, feathered, pointed laminae, equal in length and breadth, are suspended; the inner one has also a stalk-like process on its inner margin.

Gebia barbata, n. sp.

This new species is likewise a native of Luzon. Sexually mature examples are about 1 Paris inch in length.

The forehead is perpendicularly truncated in front, as in *G. major*, De Haan, so that it does not terminate in a point, as in *G. littoralis*, Risso; it is densely clothed with short hairs, and

projects but little beyond the eye-peduncles. The latter present nothing remarkable; they lie upon the first, dilated, slightly convex joint of the inner antennæ, and extend as far as the second joint. The forehead, the second joint of the inner antennæ, and the first joint of the outer ones all project the same distance forward. The three joints of the inner antennæ are all nearly of the same length; the flagellum is double, the outer one is somewhat stronger and a little shorter than the inner one—at the utmost, of the length of the thorax. The latter is straightly truncated behind; its lateral parts extend further backwards.

As regards the clothing of many parts with hair, our species resembles *G. major*, but it is smaller (*G. major* attains a length of 3 inches 7 lines) and still more abundantly clothed with hair, whence the specific name. The second joint of the outer antenna is the longest of the three, and exhibits a densely bearded line on its outer side, running obliquely, from above and behind, downwards and forwards, which gives this joint a most deceptive appearance of consisting of two joints. The first joint is armed with a spine at its inner anterior angle. This antenna only bears one flagellum, and this is of half the length of the animal. There is no trace of a scale-apparatus. The tuberculum is situated, not as in *G. littoralis*, in the middle of the ventral surface of the intercalare, but more outwardly.

The external maxillipeds are foot-like; their palpus is of the length of the second joint, and its flagellum scarcely reaches beyond the third joint. In *G. littoralis*, Risso, the palpus bears no flagellum.

The first pair of feet is subcheliform, in accordance with the generic character; the hand is furnished on the outside with a row of dense long hairs, running obliquely, from above and behind, downwards and forwards. The first three pairs of feet are strongly beset with long hairs on their lower and inner sides. The fifth pair of feet is different from the rest, and nearly subcheliform; the immoveable finger is but small and weak. This pair of feet bears no branchiæ; the branchiæ on the others are tufted. The femoral joints present a spine on the upper edge at the distal extremity.

The abdomen is at first slender, but gradually becomes broader and thicker. There are no abdominal feet on the first segment in the male. From the second segment onwards two oval fringed appendages are suspended from a short peduncle; of these, the inner one is smaller than the outer; neither of them bears a filamentous appendage. The caudal fan consists of a nearly square central piece, of which the posterior margin has a fine and short fringe. Upon this piece there is no central ridge, but

there are two lateral ridges running near and parallel to the margins, and united by a transverse ridge which runs near the articular margin. The lateral appendages are fringed all round; the inner one exhibits a central ridge, and the outer one two slightly bent faint lines on the outer half.

The subcheliform fifth pair of feet connects this species with Audouin's *Gebia stellata* in the text to Savigny's 'Description de l'Egypte.' Judging from the forehead, indeed (with regard to its projection and denticulation), the latter might be either a *Gebia* or an *Axius*; but the scale is wanting on its external antennæ, and therefore it can be approximated only to *Gebia*. The admirable figure on the tenth plate, however, shows us that this *Gebia stellata* cannot be a *Gebia* at all, but that it must form a new genus. Audouin has not given a description of the Crustacean in question; I will therefore give one here from the figure, under the name of

CALLIADNE, nov. gen.

To the species figured I give the name of *C. Savignii*. The cephalothorax exhibits in front only a small rounded frontal process, which is finely pointed in the median line, but is separated laterally by gentle sinuosities from the projecting lateral ridges, which bound the epigastral region on the sides. These ridges are beset with a row of fine teeth directed forwards, and run in the furrow which bounds the epigastral region. This region is smooth posteriorly; the larger anterior part, as far as it is bounded laterally by the denticulated ridges, and including the frontal process, is densely covered with fine teeth obliquely directed forwards. These teeth, however, are symmetrically distributed in five series, in such a way that one series exactly occupies the median line, and on each side of this two rows are placed at an equal distance between it and the lateral ridges. This structure of the forehead removes this genus more from *Gebia* than De Haan's *Laomedia*, with which our genus is probably most nearly allied on account of the cheliform first pair of feet. I must remark here that Dana's diagnosis of the genus *Laomedia*, in as far as it represents the *pedes quinti* as *obsoleti*, is founded upon a misapprehension of De Haan's statements. De Haan says, *pedes quinti desunt*; that is to say, in the example before him they had been destroyed, as may be seen distinctly from the figure of it given by him. If we had any knowledge of the fifth pair of feet in *Laomedia*, we should know with more certainty whether *Calliadne* and *Laomedia* should remain separate or be brought together in one genus.

The antennæ and the first two pairs of feet of *Calliadne* are richly clothed with long hairs on their lower surface. The joints

of the inner antenna are very unequal in length : the first joint is the longest, and the second the shortest ; the first joint is as long as the second and third together, and the third twice as long as the second. This antenna bears two flagella, of which the shorter inner one is as long as the antennal peduncle, and thicker than the other, and terminates in a rounded and almost clublike form. The outer flagellum is longer, more slender and acute.

The outer antenna possesses no scale. *Gebia*, *Laomedia*, and *Calliadne* therefore group themselves closely together. The flagellum is simple and of the length of the thorax.

The total length of the animal is 7 lines ; but unfortunately we have no information as to whether it was perfectly developed.

The outer maxillipeds are foot-like ; the outer palpus has a peduncle which is not quite so long as the second joint of the maxilliped, and it terminates in a multiarticulate flagellum.

The first pair of feet is cheliferous. The hand, which is thinly clothed with hairs all over, is laterally compressed, yet the upper margin is not sharp or keeled, but rounded ; the carpus is longer than the fingers, and the fingers are acute. The first pair of feet is the longest, measuring about two-thirds of the total length of the animal. The following feet are monodactyle, slender, thinner than the first pair ; they become shorter the further back they are situated, but the fifth pair becomes again not only longer, but also subcheliform.

The abdomen is at first slender, but becomes broader towards the middle, and then again diminishes somewhat in breadth. The abdominal feet of the first segment are simple, thin, and rudimentary ; those of the following segments bear two appendages, of which the outer is large, long, and ciliated all round, but bears no filiform process ; the inner one, on the contrary, is small, only a fourth or fifth of the size of the outer one, but also ciliated all round.

The caudal fan consists of a broad, rounded, central piece, which is of the same length with the lateral appendages ; the latter are broad ; and all are ciliated on the margins.

With regard to the characters of the sternum and of the tubercle on the intercalare, the figures give us no information. The other affinities to the *Thalassinæ*, however, allow us to suppose that there are no differences in these parts.

Even Latreille united the genera known to him of the families *Astacinae* and *Thalassinæ* subsequently established by Milne-Edwards, and De Haan contributed evidence in support of this union from their organization. The numerous *Astaci* which were afterwards made known induced Erichson to separate three

distinct genera from *Astacus*: these in various ways constituted a transition from the genus *Astacus* to the *Thalassinæ*. The union of the *Astacinae* and *Thalassinæ* has been approved of by some naturalists, for example by Gerstäcker in his Carcinological Contributions in Wiegmann's 'Archiv' for 1856; but it has been rejected by Dana in his great work on the Crustacea. Dana has united the *Astacidae* with the *Scyllaridae* and *Palinuridae*, whilst Milne-Edwards has placed the *Thalassinæ* between them. In fact, however, the *Astacidae* have much less affinity to the *Scyllaridae* and *Palinuridae* than to the *Thalassinæ*. The want of the antennal scale does not sharply divide the *Astacidae* from the *Thalassinæ*, inasmuch as there are *Thalassinæ* which exhibit traces of this organ, although but insignificant ones. Of *Thalassinæ* which possess a more or less perfect antennal scale, there are, besides *Glaucothoë* (Milne-Edwards) and *Axius* (Leach), also *Calocaris* (Bell) and even, notwithstanding the express denial of Milne-Edwards, probably the genus *Callianassa*—at least *Callianassa subterranea* (Leach) and *C. mucronata* (mihi) and *Thalassinia scorpionoides*. In the atlas to Cuvier's 'Règne Animal,' pl. 48, Milne-Edwards has given a figure of *Callianassa*, and in the further details of the organization has even perfectly and accurately represented the external antennæ; but as he had not recognized the more delicate details, the figure is deficient in this respect. The *Scyllaridae* and *Palinuridae* never have an antennal scale, and this alone would separate them more sharply than the *Thalassinæ* from the *Astacidae* sensu stricto. But, in respect to the outer antennæ, the *Scyllaridae* and *Palinuridae* exhibit a character which is perfectly foreign not only to the *Astacidae*, but also to the *Caridae*, *Penæidae*, &c. In them, namely, the elsewhere moveably articulated piece, which bears the tubercle and the perforated tympanic membrane contained in it, is intimately anchylosed to the epistomium: on account of this anatomical character, they must form a separate section of the Tubercular Decapods, repeating in a certain degree the Oxyrhynchid type of the Opercular Decapods. This anchylosis appears to occur very early; for, from the numerous observations of Coste and Couch, it is now scarcely doubtful that the *Phyllosomata*, still retained by Milne-Edwards as a peculiar genus, are the early stages of the *Palinuri*. The Zoological Museum of Berlin possesses a series of *Phyllosomata*, about sixteen in number, taken by M. Jagor in one sweep of the towing-net, in the open sea near Trinidad; these show such gradual changes in course of growth that thirteen of them may be arranged in such a manner as to demonstrate the increasing size and simultaneous alteration of the characters most evidently. As, however, these are remarkable in other respects likewise, I

must put off more detailed statements for the present, and will only mention here that even these phenomena of growth are greatly in favour of the *Phyllosomata* being the young state of some Podophthalmatous Crustacean. In all the above-mentioned *Phyllosomata*, and in the other specimens contained in the Berlin collection, I have succeeded in confirming Kröyer's observation as to the presence and position of the auditory vesicle. What Gegenbaur and Leuckart have sought in vain in fresh examples may be easily seen in spirit-specimens: the coagulation effected by the alcohol probably facilitates the detection of contours which, under other circumstances, are too delicate. Moreover, the *Phyllosomata* already possess the tuberculum; at least, this was what I considered to be the nature of a tubercle, situated close to the outer antenna. The outer antenna here is destitute of any indication of an antennal scale; and this would also be in favour of its belonging to *Palinurus*. I could not make out that the elevation considered by me as the *tuberculum* was situated on a separately articulated piece; and it would likewise constitute an agreement with the *Palinuri* that the tubercle was placed in front of the mouth upon the anterior segment, which is undivided and bears the eyes and the two antennæ*.

The position of the auditory vesicles is surprising: they are situated within the brain, and occur elsewhere in the first joint of the inner antennæ. During further growth, the auditory vesicles must push forward, and, changing their form, get into the first joint of the inner antennæ, and open themselves; whilst, on the contrary, the *tubercula* move nearer to the mouth and more towards the median line. But this must be cleared up by further observations.

In the vicinity of the elevation regarded by me as the tuberculum, and not far behind it, there is, in the interior, in front of the fan-like liver, a peculiar mass, the external contours of which, resembling convolutions of tubes, lead to the conclusion that it is a glandular organ. To this mass some filaments run from the brain; it is paler in front, darker behind. This is probably Suckow's gland, which always consists of two differently tinted portions.

From the above it appears distinctly that the *Scyllaridæ* and *Palinuridæ* are not more nearly allied to the *Thalassinæ* and *Astacinæ* than to the *Palæmones*, *Penæi*, &c. We have now to ascertain wherein consists the near affinity of the *Astacinæ* and *Thalassinæ*. In the first place, the scale of the external antennæ, which is wanting in some genera, rudimentary in others, and in others, again, more highly developed, but never attaining to the

* Perhaps the *Phyllosomata* of which Milne-Edwards says that their antennæ are "*lamelleuses*" may belong to some *Scyllaridæ*.

development found in the *Carides*, must be left quite out of the question as a variable character. But there are other agreements in the outer antenna. Thus, in the *Astacinæ* and *Thalassinæ* the tuberculum is never turned inwards towards the median line of the body, as in the *Carides*, &c., but is always either in the midst of the ventral surface of the intercalare, or even turned quite outwards (*Callianassa*). The same character is presented by the *Paguridæ*, which also agree with the *Thalassinæ* and *Astacinæ* in the fact that their thoracic segments are not firmly ankylosed together. *Homarus* forms an exception to this: it probably constitutes the transition to the *Carides*, &c., or the separation of its last thoracic segment is an embryonic character. Whilst the other *Astacinæ* group their thoracic segments 4:1, the *Paguridæ* group them 3:1:1. The *Paguridæ* have antennal scales; in the *Thalassinæ* these disappear. We have therefore in these families a group which is sharply differentiated from all other Tubercular Decapods, and, by virtue of the separation of their thoracic segments, form the most decided transition to the *Squillidæ*. Taking into consideration certain appendages of the abdominal segments of *Callianidea* and *Callisea*, which are usually identified with the respiratory organs of the *Squillidæ*, the transition is much more evident.

I place the above-mentioned families as an order amongst the Tubercular Decapods, and name them *Externa*, on account of the more external position of the tuberculum, which is their general character; opposite to them I place the rest as *Interna*, but would arrange the latter first and the former second, with the *Squillidæ* following them.

The *Externa* are cylindrical, or at the utmost somewhat laterally compressed; either they have the thoracic segments (ankylosed) 3:1:1, an antennal scale, the abdomen chiefly membranous without lateral appendages, and the inner antennæ distinguished by two flagella very different both in size and in their general nature (*Paguridæ*); or the thoracic segments are (ankylosed) 4:1 (5 only in *Homarus*), the antennæ present either a distinct or rudimentary scale, or none at all, the abdomen consists of calcified segments with lateral appendages, and the inner antennæ bear two not remarkably dissimilar flagella (*Astacinæ* and *Thalassinæ*).

The *Galatheidæ* and *Ægleidæ* certainly approach most closely as regards the characters of their thoracic segments (4:1); but they are *Interna*, have no antennal scale, possess a vertically compressed body, and form with the *Porcellanæ* a well-marked group.

The objection that the *Paguridæ* have quite a different developmental history—the *Paguri*, according to Rathke and Philippi,

escaping from the egg in the form of *Zoëa*—is not very difficult to answer; for the above-mentioned observers state particularly that the *Zoëæ* observed by them had something very peculiar about them, namely, the scale on the outer antenna. Philippi even figures this; and the peculiarity of the *Paguridæ* is that the thoracic legs are only subsequently developed, just like the appendages of the abdomen. In the subsequent development, the legs appear no longer to occur with two rami; at least, Rathke says nothing decisive upon this point, although he particularly states, with regard to the maxillipeds, that these are biramose.

Upon *Galatea rugosa* Rathke says but little. Its mature embryos agree in structure with those of *Pagurus*. But here our first question would be, whether these embryos have a scale on the outer antenna, this being absent in the perfectly developed animal. From the materials available to us, which indeed are but scanty, it appears as if the mature embryos did not differ essentially from the fully developed animals in respect of the organization of the eyes and of the outer and inner antennæ. That during development definite lower forms must be passed through does not appear to be the rule among the Crustacea. I am only acquainted with one instance which is in favour of it. Milne-Edwards states that he has observed that, in mature embryos of *Naxia serpulifera*, the first joint of the outer antenna is not anchylosed with the surrounding parts, but still exists separately (*Annales des Sciences Nat.* 2 sér. iii. p. 331). From this we should expect to find something similar in the *Palinuridæ* and *Scyllaridæ*. But if the *Phyllosomata* be their larvæ, we must again hesitate, from what is stated above, before setting up Milne-Edwards's observation as a rule.

As above mentioned, the *Thalassinæ* and *Astacinæ* are not much compressed laterally, at least not in the same degree as many *Palemones*, and especially the *Penæidæ*; by this means it is of course possible that the sternum may become developed to a greater breadth. Many of the forms belonging here want the appendages of the first abdominal segment which act as external male sexual organs. According to Thomson, the copulation of these also takes place in a peculiar manner. Perhaps, in connexion with this, the sternum of the female is constructed differently from that of the male. Not only are the sternal plates of the fourth thoracic segment considerably larger, as is likewise the case even in the male, but also those of the third segment, and consequently a peculiar way is established from the female sexual orifices towards the abdomen.

I have seen this in *Cambarus*, *Engæus*, *Axius*, *Gebia*, *Calocaris*, *Callianassa*, and *Thalassinæ*; and it occurs, no doubt, in all

Thalassinæ. I have not yet examined the *Paguridæ* in this direction. Nowhere else am I acquainted with a similar structure of the sternum, except in a *Penæus* from Manilla, the female of which presents a peculiar soft structure on the fifth segment of the thorax. This is a round, chitinous, but uncalcified disk, which bears an elevated ridge in the middle, running from before backwards, the whole length of which is deeply slit, but in such a way that its lips close tightly. The function of this organ is quite enigmatical, and nothing analogous to it is known in other *Penæi*.

XLIII.—*Contributions to an Insect Fauna of the Amazon Valley.*

COLEOPTERA : LONGICORNES. By H. W. BATES, Esq.

[Continued from p. 124.]

Genus STEIRASTOMA, Serv.

Serville, Ann. Soc. Ent. Fr. iv. 24.

This is a well-defined genus, not very closely allied to any of the preceding. Its nearest relationship seems to be with those species of *Acanthoderes* which have slender fore tibiæ, rounded anterior acetabula, and closed acetabular sutures, tricarinate thorax, and prominent centro-basal ridges continuing as smooth carinæ to the apex of the elytra. It differs, however, from *Acanthoderes* in the complex tuberculation of the sides of the thorax. Instead of a simple lateral conical tubercle or spine, as is usual in the Longicorn family, the thorax presents, on each side, an irregular prominence furnished with three tubercles. In some species this prominence is very strongly developed, and then two of the tubercles are carried to the apex, giving it a bifid appearance, the third remaining at the base beneath. All the species have, besides this tricuspid prominence, an acute tubercle on each side near the fore margin of the thorax; and some present, in addition to this, a similar pointed wart on the side, some distance above it. The muzzle, although similar in shape to that of *A. bivitta*, is considerably longer and more broadened anteriorly than in any species of *Acanthoderes*, and the fore angles are more strongly pronounced. The mandibles are long, very slightly bowed, and much flattened. The centro-basal ridges of the elytra are curved outwards and prolonged behind as more or less flexuous smooth keels to the apex. In the males of some species the basal joint of the antennæ forms an irregular many-angled club, and is longer in proportion to the third than is the rule in the section to which the genus belongs.

1. *Steirastoma depressum*, Fabr.*Cerambyx depressus*, Fabr. Ent. Syst. i. ii. 260. 32.

St. breve, depressum, postice valde attenuatum, nigrum, tenuiter griseo tomentosum: thoracis lateribus quinquetuberculatis, dorso depresso tricarinato: elytris subtrigonis, carinis centro-basalibus valde curvatis ramulum suturam versus emittentibus, apice spinosis: pedibus nigris, cinereo obscure variegatis: corpore subtus nigro, nitido, lateribus ochraceo tomentosus. Long. 7-11 lin. ♂ ♀.

Head black, scantily clothed with grey tomentum, sparingly punctured with three raised longitudinal lines, the lateral ones flexuous, the central one straight and running from the vertex to the edge of the epistome. Antennæ half as long again as the body in the ♂, a little longer than the body in the ♀, black, the bases of the joints ashy; the first joint in the ♂ of an irregular clavate shape, rugose, tuberculated at the apex. Thorax punctured near the fore and hind margins; the sides have each five tubercles, two anteriorly and three on the moderately produced lateral prominence; the dorsal carinæ are smooth, and shining black, the lateral ones being flexuous, interrupted, and tuberculate. The elytra are clothed with thin ashy tomentum, streaked and spotted with black; the centro-basal ridges are granulated and strongly curved, the posterior end of the curve emitting a short branch towards the suture; afterwards each is continued as a flexuous and smooth keel to the apex: the apex itself is produced into a strong tooth or spine, which varies in length in different individuals. The fore legs of the ♂ are much elongated.

This is a common Guiana species, and is generally distributed throughout the Amazon region, being found everywhere in new clearings, sometimes under the loose bark of trees. Like all the other species of the genus, it is sluggish in its motions, and feigns death when touched, bending its legs in a rigid position, and falling to the ground. As the Fabrician description is insufficient, and his name has been referred to a nearly allied but distinct South Brazilian species, I have thought it necessary to give a lengthened diagnosis. According to the British Museum collection, the *C. depressus* of Fabricius is the same as the *C. brevis* of Sulzer, an earlier author, and applies to the larger species of South Brazil above mentioned. I think, however, the description of Fabricius quoted above cannot apply to any other than the one I have described. It is probable, also, that Sulzer and the other old authors had the Guiana species in view in their *C. brevis*; for the productions of Brazil were not known in Europe at the time they wrote. I do not adopt Sulzer's name, however, because it is likely that the *C. depressus*

of Linnæus, since Mr. White applies it to the Guiana insect, is the same species as the Fabrician; and therefore the name *depressus*, again having the priority, would stand. I have no means of deciding this point. Linnæus gives Coromandel as the locality of his *C. depressus*; and Fabricius does not quote his name in the synonymy. I have received a pair of *Steirastoma depressum* from M. Deyrolle of Paris, as coming from Venezuela, under the name of "*St. difformis*" of Dejean. It is considerably modified from the Guiano-Amazonian type, being more closely tomentose, and ochreous rather than grey in colour.

2. *Steirastoma melanogenys*, White.

Steirastoma melanogenys, White, Cat. Long. Col. in Brit. Mus. ii. p. 355.

The male in this species has a strong tooth or spine on the inner edge of the fore tibiæ near the middle. This was overlooked by Mr. White; otherwise his description, as cited above, leaves nothing to desire. This insect is the "*St. aculeata*" of Dejean's catalogue, according to specimens I have received from Paris. Cayenne examples do not differ at all from those found in the Amazon region. I met with the species only in the central parts of the Lower Amazons, at Obydos and Santarem.

3. *Steirastoma cænosum*, n. sp.

St. modice elongatum, postice attenuatum, depressum, tomento cervino-fusco vestitum: capitis thoracisque lateribus et plagis magnis duabus elytrorum fuscis: elytris apice valde spinosis. Long. 10 lin. ♀.

Head and labrum densely clothed with ashy-brown pile, the former punctured in front and marked with three fine longitudinal raised lines on the epistome, the central one extending to the vertex; the sides black. Antennæ brown; the third joint beneath with three very fine spines placed widely apart. Thorax quadrituberculate on each side, the lateral prominence very large, trituberculate, and the tubercle near the fore angle prominent; the dorsal surface depressed, punctured, tricarinate; the central keel very faint, the lateral ones prominent, flexuous; densely clothed with light-brown pile, the sides with a stripe of a coffee-brown colour between the lateral keel and the tubercles. Elytra depressed, elongate, subtrigonal; the centro-basal ridges prolonged behind to the apex, gently curved outwards and granulated from the base to two-thirds the length, then flexuous and smooth to their termination: the surface faintly and sparingly granulate-punctate, with a few large granulations, besides, on the shoulders; light or tawny-brown in colour, with a silky gloss; the sides have each two large irregular patches of a coffee-

brown colour, one covering the shoulder and extending in a short streak to the disk, the other placed obliquely a little behind the middle; the apex of each elytron is produced into a spine. Body beneath thickly clothed with ashy-brown pile; the middle of the abdomen shining black. Legs thinly covered with ashy-brown pubescence.

One example, taken at Oyayá, banks of the Curuá, below Santarem.

The species is nearly allied to *St. melanogenys*, but differs in the shape and position of the spines beneath the third antennal joint, in its clothing and markings, and in the apex of the elytra not being squarely truncated with a spine at the external angles, but produced on each elytron into a stout spine.

4. *Steirastoma æthiops*, n. sp.

St. modice elongatum, depressum, supra tomento atro-griseo vestitum: capitis thoracisque lateribus et plagis magnis duabus elytrorum nigris: elytris apice valde spinosis. Long. 8-10 lin. ♂ ♀.

Head and labrum clothed with very dark-grey pile, the former with three longitudinal raised lines on the front, the central one extending to the nuchus, the lateral ones short and very prominent; sides black. Antennæ black; bases of the joints greyish, the third with a few very fine spines or bristles beneath, placed wide apart; the basal joint in the ♂ pyriform-clavate, smooth. Thorax quadrituberculate on each side, the lateral prominence very large, trituberculate, the tubercle near the fore angle prominent; the dorsal surface depressed, punctured, tricarinate; the central keel very faint, the lateral ones strongly pronounced; thickly clothed with very dark-grey pile, the sides each with a black stripe between the lateral keel and the tubercles. Elytra depressed, elongate, subtrigonal; the centro-basal ridges prolonged behind to the apex, strongly curved outwards, and granulated to two-thirds the length, then flexuous and smooth to their termination; the surface faintly and sparingly granulate-punctate, with a few large granulations, besides, on the shoulders; very dark grey, the sides having each two large, irregular, black patches—one, which is sometimes broken into smaller spots, covering the shoulder and extending in a slender streak to the disk, the other placed obliquely a little behind the middle; the tips of the elytra are briefly sinuate-truncate, the external angles produced into stout spines. Body beneath and legs clothed with very dark-grey pile; the middle of the abdomen naked, shining black. The fore tibiæ of the ♂ are untoothed.

This species occurred only at Ega and St. Paulo, on the Upper Amazons. It differs very little, except in colour, from *St. canosum*, and may be considered a geographical variety or race of

that species. I have not seen either form in collections from other parts of South America.

Genus *PLATYSTERNUS* (Dej.), Blanch.

Blanchard, *Histoire des Insectes*, ii. 156.

The few words given by Blanchard as generic characters, in the place above quoted, have little or no meaning; the genus, however, is well known to entomologists from the figure given by Olivier of the only described species. It is a singular form of *Lamiaire*, partaking of the characters of *Steirastoma* and the *Anisocerinæ*—two widely different groups. The shape of the thorax, the closed acetabular sutures, and the direction of the centro-basal ridges of the elytra show a near affinity with the *Steirastomata*; whilst the form and smoothness of the muzzle, the broadly rounded apices of the elytra, and the depression of the fore edge of the metasternum are so many points of resemblance to the *Anisocerinæ*. The lateral prominences of the thorax are not simple, but bicuspid, the anterior cusp, however, being very much smaller than the posterior one. The antennæ are slender, one-fourth shorter than the body, and the eleventh joint, as in most of the *Anisocerinæ*, is much shorter than the tenth.

Platysternus hebræus, Fabricius.

Cerambyx hebræus, Fabr. Mant. Ins. i. 131.

—, Oliv. Ent. iv. p. 62, t. 15. f. 106.

I met with this rare and magnificent insect only at Caripí, near Pará. It was there found in some numbers, gnawing the bark of living Guariúba trees—a lofty tree of the order Leguminosæ, whose bark is thick, smooth, and friable, and much frequented by bark-feeding insects, especially Curculionides of the group Cryptorhynchini. Cicindelidæ of the rare genus *Iresia* are sometimes seen on the same tree, coursing over the trunk and preying upon the vegetable feeders; in fact, I never met with *Iresia* except on Guariúba trees. The large *Cratosomi* sometimes abound, and gnaw large holes in the bark. These insects do not seem to breed in the wood of the standing trees, but merely to resort to them for the purpose of gnawing the bark.

I have seen a second and undescribed species of *Platysternus* in the collection of Count Mniszech, at Paris.

Genus *POLYRHAPHIS*, Serv.

Serville, Ann. Soc. Ent. Fr. iv. 26.

From the seemingly capricious way in which the various parts of structure that, in other Coleoptera, furnish signs of affinity

are modified from genus to genus in the Longicorn family, it is difficult to decide on the true position and relationship of the present group. In the general shape of the body, as well as in the form of the muzzle, thorax, and apex of the elytra, it seems to approach the genus *Acrocinus*. The antennæ, however, are quite glabrous beneath, instead of being ciliated partially or wholly as in *Acrocinus*; and the fore tarsi of the ♂ are dilated and ciliated, instead of being simple. In the proportions of the apical joints of the antennæ there is a great similarity between *Polyrhaphis* and the Anisocerinæ, the terminal joint in both sexes being extremely short compared with the penultimate. This seems to be a significant character. The form of the muzzle, too, is not greatly different from that of the Anisocerinæ; but the general form, the shape of the elytra and of the sterna, reveal no affinity with that group. The genus seems to have no close relationship with any other group of Lamiaires: it shows some resemblance to *Acrocinus* and the Anisocerinæ; but many intermediate links are wanting to prove a genealogical relationship. The prosternum is extremely narrow in this genus, and the mesosternum is contracted in the middle between the haunches. The anterior acetabula gape widely on the sides, the sutures being opened along their whole length. The genus is a very natural or well-defined one, comprising a cluster of species which agree with each other in facies as well as in structural characters. They are all of large size, have greatly elongated, filiform, rather stout antennæ, long and acute lateral thoracic spines, sometimes directed forwards, and ample oblong elytra, whose apices are broadly truncated and spined.

1. *Polyrhaphis spinosa*, Drury.

Lamia spinosa, Drury, Illustr. ii. p. 60, pl. 31. f. 3 (1773).

Cerambyx horridus, Oliv. Ent. iv. 66, pl. 4. f. 29 (1789–1808).

Lamia horrida, Fabr. Ent. Syst. i. ii. 273. 25 (1792).

The figures given by Drury and Olivier agree well in shape and form of the spines with the insect I have before me, taken at Villa Nova, on the Lower Amazons. My example, however, appears to be of a lighter colour. The general hue of the tomentum is hoary or ashy, the elytra, with the exception of the basal and apical parts, being of a violet-brown colour. The shape of the elytra in this species is elongate-quadrate, being only slightly narrowed posteriorly, with the base and apex rectangular, and the sides nearly straight. The spines on the elytra are as follows:—a row of small ones placed close to the suture, but deficient near the base and the apex; three large ones on the centro-basal ridges, two on the shoulders, and five or six very long ones on the disk. It occurs in Guiana as well as the

Amazon region, and appears to be a rare insect. I met with only one example, which was found closely adhering to a dead branch, and scarcely distinguishable from it on account of the colours resembling those of the lichens with which the wood was covered.

2. *Polyrhaphis hystericina*.

P. brevis, subconvexa, spinosa, tomentosa, cervino-fusca, postice cinereo variegata: thoracis spinis antrorsum valde curvatis: elytris truncatis, angulis internis acutis, externis valde productis. Long. 12 lin. ♂.

Head scantily punctured, dull black, clothed with tawny-brown pile. Antennæ dark brown. Thorax punctured near the fore and hind margins, clothed with tawny-brown pile clouded with dusky; dorsal tubercles very large, obtuse; lateral spines strong, elongated, and more strongly curved forwards than in *P. spinosa*. Elytra rather short, subquadrate, slightly but gradually narrowed from the base, the sides nearly straight to three-fourths the length, and then gradually rounded to the apex, which is broadly truncated; the sutural angle very slightly produced, and the external one armed with a stout spine: the surface is studded with stout but not long or acute spines; there are five or six in a row on the strongly-raised centro-basal ridge, three or four along the suture near the middle, several smaller ones on the shoulders, and a short series of three or four between the shoulders and the centro-basal ridge, and, lastly, five on the disk, namely, two in the middle and three on the posterior part; the interspaces are studded with large, deep, and shining punctures, the apical portion of the elytra behind the spines alone being entirely smooth. Under surface of the body and legs black, thinly clothed with brownish pile; tarsi and a ring at the tips of the femora bright fulvous.

There is a specimen of this species in the British Museum, ticketed "*P. hystericina*, White," which name I have adopted; it is larger and paler in colour than my example, but agrees with it in all other respects. It appears to be a rare species. My specimen was taken near Pará.

3. *Polyrhaphis angustata*, Buquet.

Polyrhaphis angustatus, Buquet, Ann. de la Soc. Ent. de France, 1853, p. 445.

This species has been described at length by M. Buquet in the place quoted. It is an elongated parallel-sided species, 14 lines long; the elytra are free from spines or tubercles, being simply granulate and punctate partly in rows, but smooth towards the apex. The spines of the thorax are long and straight. The general colour is dull-reddish brown, varied with small

specks and clouds of a dark-brown hue. The fore tarsi in the ♂ are feebly dilated and fringed, and the antennæ in the same sex are nearly twice the length of the body.

I met with the species on the banks of the Tapajos and at Ega. The examples found do not differ from the Cayenne specimen which I saw in M. Buquet's collection. The insect is found on the trunks of fallen trees in the virgin forest. Like many other large species of Longicornes, it comes abroad at night, and flies over broad rivers. I once found an individual along with many other dead or half-dead insects on a sand-bank in the middle of the Tapajos, which had been cast ashore after falling into the water during a squall in the night.

4. *Polyrhaphis gracilis*, n. sp.

P. elongata, angustata, subconvexa, tomentosa, violaceo-fusca: thoracis lateribus elytrisque postice flavo variegatis: elytrorum apicibus rotundato-truncatis, angulis externis spinosis. Long. 8 lin. ♀.

Head clothed with reddish pile, sides black; front coarsely punctured; muzzle short. Antennæ the length of the body, dull brown. Thorax punctured, reddish in colour, the sides behind varied with yellowish; the two dorsal tubercles small; the lateral spines long, slender, and slightly bent forwards. Scutellum yellowish. Elytra narrow, much elongated, and somewhat convex, gradually increasing in breadth from one-third to two-thirds their length, then slightly narrowed to the apex, which is obliquely and obtusely truncated, the external angle of the truncation produced into a spine; the basal half of the surface is thickly granulate-punctate, the apical portion entirely smooth; the colour is a dull-reddish or violet brown, the smooth posterior portion being varied with ashy yellow. The body beneath and legs are black, thinly clothed with ashy pile.

I only obtained one example of this small and elegantly shaped species, which was taken at Ega, on a dead branch.

5. *Polyrhaphis papulosa*, Olivier.

Cerambyx papulosus, Oliv. Ent. iv. 72, pl. 20. f. 156.

This fine species is found at Cayenne and, according to Erichson (Consp. Ins. Peruana) in the forest region of Eastern Peru. My only example, a ♀, 15 lines in length, was taken on a slender dead branch in the forest at Ega—a locality midway between the two regions.

6. *Polyrhaphis Jansoni*, Pascoe.

Polyrhaphis Jansoni, Pascoe, Trans. Ent. Soc. Lond. v. n. s. pt. 1.

Mr. Pascoe, in the description referred to above, likens this

species to the common *P. spinipennis* of Laporte, a native of South-east Brazil. It does not seem very closely allied, however, to that species. The elytra are less depressed, more thickly and deeply punctured on the base and disk, and less parallel-sided, being broad at the base and more tapering to the apex. In general outline it more nearly resembles *P. papulosa*. The colour above is fulvescent or tawny brown, the apical third of the elytra variegated with fine longitudinal streaks of a darker-brown hue. The bright-fulvous tarsi and the fulvous apical ring of the femora, contrasted with the deep-black legs, are features it possesses in common with *P. hystricina* and the following form, *P. Paraensis*. The surface of the elytra, except the apical portion, is studded with short obtuse spines, or, rather, conical tubercles; these vary in number in different examples, as they do in most species of *Polyrhaphis*; but, as is usual in the genus, they are constant in position. There is a row along the prominent centro-basal ridge, a series of three or four along the suture near the middle, and two oblique rows along the middle of the disk, the inner one of which extends in a flexuous direction to the base of the elytra. Besides these spines, the elytra on the sides and shoulders are thickly studded with tubercles arranged in rows, each accompanied, as the spines also are, by a large and deep puncture. The disk of the elytra towards the suture is much depressed, and, with the interspaces of the base, is thickly punctured; the apical third of the surface is smooth and impunctate. The apex of the elytra is truncated, the sutural angle has a very small projecting point, the external one being produced into a spine. The length varies from 9 to 15 lines.

This species is rather common at Ega, on the trunks of fallen trees in the forest. It is also found on the banks of the Cuparí, an affluent of the Tapajos.

7. *Polyrhaphis Paraensis*, n. sp.

P. oblonga, tomentosa: capite fuliginoso: thorace fulvescente: elytris fuliginosis, basi et pone medium cervino variegatis: elytrum tuberculis ut in *P. Jansonii* dispositis. Long. 10 lin. ♀.

Head and antennæ sooty black, the former punctured in front. Thorax fulvous, the disk clouded with dusky; the lateral spines straight, the dorsal tubercles acute. Elytra broad at the base, then gradually narrowed to three-fourths their length, whence they are more abruptly narrowed and rounded to the apex, which is truncated; the sutural angles simply pointed, the external ones produced into spines; the tubercles and punctures on the surface are arranged precisely as in *P. Jansonii*, but the colour is different; the base is of a tawny-brown hue, the central parts

and the apical third sooty brown, the interval between these darker patches being of a paler tawny colour. Legs black, a ring at the apex of the femora and the tarsi bright fulvous.

This species, which is no doubt a local modification of *P. Jansoni*, is found at Pará.

[To be continued.]

XLIV.—On *Antiaris Bennettii*, a new Species of Upas-Tree from Polynesia. By BERTHOLD SEEMANN, PH.D., F.L.S.

Antiaris Bennettii; arbor mediocris; ramulis petiolisque pubescentibus, demum glabris; foliis brevipetiolatis ovato-oblongis acuminatis integerrimis, basi inæquali-cordatis, utrinque subglabris, supra lucidis; floribus masculis fasciculatis (2–4), pedunculis velutino pubescentibus, involucri laciniis ovato-acuminatis perigoniorum longitudinem reflexis, fœmineis solitariis; drupa ovato-acuta, dense velutina (v. v. sp.).

Antiaris Bennettii, Seem. in Bonplandia, vol. ix. (1861), p. 259, et ibid. vol. x. p. 3, t. 7 (1862).—Bennett's Gatherings of a Naturalist in Australasia (London, 1860), p. 403.

Nomen vernaculum Tucopiense 'Mami,' teste G. Bennett; Vitiense 'Mavu ni Toga,' teste Seemann.

Geogr. Distribution; Viti Levu, about Namara, and Moturiki (Seemann! n. 449, Harvey!).—Tucopia, lat. 12° S., long. 169° E. (G. Bennett! in Herb. Hook.), and Wallis Island, lat. 16° 30' S., long. 176° W. (Sir E. Home! in Mus. Brit.)

Hitherto only three species of *Antiaris* were known, viz., *A. toxicaria*, Lesch. (the genuine Upas-tree of Java), *A. innoxia*, Bl., and *A. macrophylla*, R. Br. A fourth species (ramis folisque utrinque velutinis) is cultivated in the Royal Botanic Gardens at Kew. A fifth species was found by Thwaites in Ceylon, and has been described by me as *A. Zeylanica* (Bonpl. x. p. 4, in adnot.); it is called by the Cingalese "Ritti-gass," and supplies, like *Q. saccidora*, Dalz. materials for sacks. In his 'Enumeration Pl. Zeyl.' p. 263, Thwaites classes it with *A. innoxia*, Bl., and *A. saccidora*, Dalz.; but I am by no means certain that even *A. innoxia* and *A. saccidora* are identical, and feel convinced that *A. Zeylanica*, Seem., is a very distinct species, at once distinguished from *A. saccidora*, Dalz., of which Wight gives a figure, by its scabrous leaves and pear-shaped fruits*. A

* *Antiaris Zeylanica*; arbor excelsa; ramulis, petiolis, pedunculis drupisque velutinis; foliis obovato-oblongis, acuminatis, integerrimis, supra scabris, subtus hirtellis; involucri masculi laciniis perigoniorum longitudinem reflexis; drupa obovato-obtusa (v. s. sp.).—*A. Zeylanica*, Seem. in Bonpl. vol. x. p. 4, in adnot. *A. innoxia*, Thwait. Enum. Pl. Zeyl. p. 263, non Bl., excl. syn. omn.—In Zeylanica, ubi, teste cl. Thwaites,

sixth species of *Antiaris*, if not a seventh, is the one which, in honour of its original discoverer, I have named *A. Bennettii*. It is closely allied to *A. macrophylla*, R. Br., from the northern parts of New Holland, but at once distinguished in having fruits covered with a thick coating of velvety hair. It had been found in Fiji, first by Prof. Harvey, afterwards by me. About thirty years earlier, however, viz. in May 1830, the plant had been discovered by Dr. George Bennett, of Sydney, New South Wales, on a small island situated N.W. of Fiji, in lat. 12 S., long. 169 E., and was thus alluded to in his 'Gatherings of a Naturalist in Australasia' (8vo. London, 1860, p. 403):—

"When visiting the Island of Tucopia in May, I observed the *Antiaris*, or Upas-tree, planted in rows near the native huts; but I am not aware that it is indigenous. It is named 'Mami' by the natives; it is allied to the celebrated Upas-tree of Java, and accords with *A. macrophylla*, described and figured by the late Dr. Brown in the Appendix to 'Flinders's Voyage.' The tree at Tucopia is of slender growth, with pendulous branches; it was growing to the height of 8 to 12 feet. The leaves are oblong, large, pointed, distinctly veined, and of a light-green colour. The fruit is oval, rather larger than a pigeon's egg, rough externally, and of a beautiful crimson colour. Between the husk and kernel there is a quantity of white viscid juice. The kernel, of white colour and intensely bitter taste, is enclosed in a thin shell of a grey colour. It is planted by the natives either for dyeing or manufacturing the bark into native cloth. Specimens in fruit and flower are in the Botanical Collection of the British Museum." Thus far Dr. Bennett.

"A species of Upas" (*Antiaris Bennettii*, Seem.), I wrote in my Official Report on the Vitian or Fijian Islands, "commonly termed Mavu ni Toga (=Tonga), probably because it has been introduced from the Tongan Islands, was formerly planted about heathen temples, and is even now to be found in towns and villages. It is a middle-sized tree, with a thick crown of foliage, oblong glossy leaves, and a fleshy fruit of the size of an apricot, covered with a velvety skin of a most beautiful crimson colour. A gum exuding from the stem and branches is used for arrows. The exact nature of its poisonous qualities has not yet been ascertained. That they are not equal to those ascribed to the true Upas-tree of Java (*A. toxicaria*, Lesch.) is proved by the manner in which the natives handle it; but it is impossible to say whether one of the reasons for its cultivation near temples, and its probable introduction from Tonga, may not be

'Ritti-gass' vocatur.—The fruits of *A. saccidora*, Dalz., are elliptical in shape, as may be seen in the figure of it given by Wight, who distinctly states that his plate represents the Indian, not the Cingalese plant.

found in its yielding a poison, of which the heathen priests may have occasionally made use."

"Mavu ni Toga" literally means, the Mavu from the Tongan Islands; and it is not improbable that the tree may have been introduced from there. I have not met with any specimens from Tonga in our herbaria; but that would not prove that *Antiaris Bennettii* has originally not been derived from Tonga, as that group has been explored only very superficially, and Sir E. Home found it east of Fiji, viz. at Wallis Island, in long. 176° W. For the present, Viti must be regarded as the extreme southern limit of this species (and also of the genus *Antiaris*), and Tucopia as the northern. It is note-worthy that neither Bennett nor I found this species in a truly wild state; for in Viti it looks as if originally planted. The beauty of the foliage and the rich colour of the fruit fully entitle it to a place in our European conservatories; and we were so much struck with these qualities, that Mrs. Smythe made a coloured drawing of the plant on the spot, which, together with the dried specimens, served as the basis of the plate (tab. 7) published in the 'Bonplandia.'

BIBLIOGRAPHICAL NOTICE.

Anahuac; or, Mexico and the Mexicans, Ancient and Modern.

By EDWARD B. TYLOR. 8vo, 1861.

THIS interesting book is a narrative of excursions in Mexico, during the spring and summer of 1856, by the author and a friend, both of whom were well prepared by previous study and pursuits to observe carefully, and accurately note, the many points of interest afforded by the country, the people, and the antiquities of Mexico. Making their visit during a lull in the civil turmoil of that lamentably disturbed republic, they were fortunate in being able to avail themselves of that peaceable season in making excursions to remarkable places and ruins, and examining the national collection of antiquities and other objects of interest,—an opportunity that cannot have occurred since, owing to the recommencement of civil war in its worst form.

The evidences of an immense ancient population, shown by the abundance of remains of works of art, are especially treated of in the course of the narrative. The Mexican numerals, Mexican eclipses, Mexican art, and its connexion with that of Central America, are also well treated of. The ethnological relations of the Mexicans or Aztecs, their religion, civilization, and language, are largely treated of, as well as the present condition of their still numerous descendants.

With respect to subjects more closely related to natural history, we find numerous topics of interest brought forward by Mr. Tylor. From the beginning of the volume to the end, the author continually

draws our attention to natural phenomena, striking, interesting, or picturesque. Before starting for Mexico the author and his friend, Mr. Christy, were at Havana for a time. A journey by railway across Cuba took them through the thick tropical jungle of Indian fig-trees, acacias, mimosas, the seiba, the mahagua*, and other trees, with epiphytes and binding creepers, bamboos in the swamps, and tufted palms on the higher grounds.

The Isle of Pines, with its densely wooded creeks, once the resort of pirates, is now the fashionable watering-place of the Cubans, and is a settlement for the free blacks of Florida, who chose to leave that country when it was given up to the United States. In the middle of the island are marble-quarries, not much worked now. Leaving the quarries, our tourists, riding over the wide savannahs, were able to recognize the sudden transitions from the tropical jungles of the streams to the palms of the slopes and the pine-trees of the hill-tops, for which this island is remarkable (pp. 6 and 7).

The characteristic natural features of the *tierra caliente*, *tierra templada*, and *tierra fria*, on the road from Vera Cruz to Mexico, are vividly sketched, and the geographical and geological conditions on which they are dependent are succinctly described (pp. 27 and 28).

A visit to the silver-mines at Real del Monte affords much interesting matter, in Chapter IV., both as to the country and the people. "The plateau of Atotonilco el Grande, called for shortness 'Grande,' is, like most of the high plains of Mexico, composed mostly of porphyry and obsidian—a valley filled up with débris from the surrounding mountains, which are all volcanic, embedded in reddish earth. The mountain torrents, in which the water, so to speak, comes down all at once—not flowing in a steady stream all the year round as in England—have left evidences of their immense power in the ravines with which the sides of the hills, from their very tops downward, are fluted. These fluted mountain-ridges resemble the 'Kamms' (combs) of the Swiss Alps, called so from their toothed appearance" (pp. 84 and 85).

The market at Grande (page 88) gave the author a good opportunity of studying people and things. Amongst other observations, he says, "I never so thoroughly realized before how climate is altered by altitude above the sea, as in noticing the fruits and vegetables that were being sold at this little market, within fifteen or twenty miles of which they were all grown. There were wheat, and barley, and the piñouls (the fruit of the stone-pine, which grows in Italy, and is largely used instead of almonds); and from these representatives of temperate climates the list extended to bananas and zapotes, grown at the bottom of the great barrancas, 3000 or 4000 feet lower in level

* "The mahagua tree," says the author, "furnishes that curious fibrous network which is known as 'bast,' and used to wrap bundles of cigars in. The mahogany-tree is called 'caobo' in Spanish—apparently the original Indian name, as the Spaniards probably first became acquainted with it in Cuba. Is our 'mahogany' the result of a confusion of words, and corrupted from 'mahagua?'"—Page 2.

than the plateau, though in distance but a few miles off. Three or four thousand miles of latitude would not give a greater difference."

The great barranca of Regla is next described (p. 89). The oaks at the top of the barranca, with their branches fringed with the long, grey "Spanish moss" and a profusion of brightly blossoming epiphytes clinging to their bark, claimed attention, as well as the cactuses, of many species. The great valley itself—a mile or two in width, with sides almost perpendicular, and capped with basaltic pillars, and at the bottom a strip of land where the vegetation is of the deepest green of the tropics, with a river winding along among palm-trees and bananas—is between two and three thousand feet deep; and the view is wonderful.

The author makes the following among other notices of the mining establishment at Real:—"The original English company spent nearly one million sterling on it, without getting any dividend. They sold it to two or three Mexicans for about twenty-seven thousand pounds; and the Mexicans spent eighty thousand more on it, and then began to make profits. The annual profit is now some £200,000" (p. 107).

The celebrated cascade of Regla, near the silver-mines, is illustrated by a lithograph (frontispiece), copied from a good photograph, and is described, with its precipitous walls of columnar basalt and gigantic yuccas. Joints of these columns are used as crushers in the ore-crushing mill, being dragged round and round, by mule-power, on a floor made also of basalt.

Near Regla occur the quarries of obsidian, at the Cerro de Navajas ("Hill of Knives"), where the Aztecs worked that stone into knives and other implements in immense quantities. At Teotihuacan, also, was a similar knife-manufactory. Valuable information on this subject is given at pages 96, 137, &c., and in the Appendix. Not far from this are the Peñas Cargadas ("the Loaded Rocks")—"several sugar-loaf peaks, some three hundred feet high, tapering almost to a point at the top, and each one crowned with a mass of rocks, which seem to have been balanced in unstable equilibrium on its point, looking as though the first puff of wind would bring them down. The pillars were of porphyritic conglomerate, which had been disintegrated and worn away by wind and rain; while the great masses resting on them, probably of solid porphyry, had been less affected by these influences" (pp. 94 and 95).

Among other geological phenomena, the accumulation of alluvium at Tezcuco is described; and the value of the evidence that alluvial deposits bear respecting chronology in Mexico, Egypt, and Sicily is briefly discussed.

The great stalactitic cave of Cacahuamilpan, vast and beautiful (pp. 203, &c.), and the great cone and crater of Popocatepetl (pp. 236, &c.) were visited, and are carefully described; and amongst the more or less common objects of natural history, the aloes (and the making of *pulque*), auts, cactuses, cypress-trees, edible insect-eggs of the Tezcuco Lake, hill of magnetic iron-ore of Huetamo, saline condition of the soil, and sand-pillars are described in some detail, and may

be found by reference to the index of the volume. Four lithographs, numerous good woodcuts, and a well-compiled map (by Lowry) illustrate this really amusing and instructive volume of Mexican travel.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

December 10, 1861.—Professor Busk, F.R.S., in the Chair.

ON A NEW SPECIES OF PLECTROPOMA FROM AUSTRALIA.

By DR. ALBERT GÜNTHER.

PLECTROPOMA RICHARDSONII.

D. $\frac{10}{18}$. A. $\frac{3}{8}$. L. lat. 105.

The height of the body is contained four times and a half in the total length, the length of the head three times and a quarter. Inter-orbital space concave, half as wide as the orbit. Snout conical, with the lower jaw produced. Cleft of the mouth wide, the maxillary extending behind the orbit. Dentition very strong; the upper jaw with a patch of cardiform teeth in front, and a narrow villiform band on the side; there is a very long curved canine tooth on the outer side of the cardiform teeth, followed by a series of five or six teeth of moderate size. Lower jaw with a pair of very strong canines anteriorly, and with four or five strong, canine-like teeth on the side. The upper canines are received in a notch behind those of the lower jaw. Vomerine and palatine teeth in a narrow band, the former angularly bent.

Lower jaw more than half as long as the head. Præopercular margin rounded, finely serrated posteriorly, and with a small spine on the middle of its inferior margin, pointing forwards. Pectoral rounded, scaly at the base, as long as the mandible; ventral not quite half as long as the head. The spinous dorsal is separated from the soft by a very deep notch: the spines are rather slender; the fifth and sixth are the longest, one-fourth of the length of the head. The soft portion higher than the spinous, with the upper margin nearly even; base scaly. The second anal spine as long as, but stronger than, the third. Caudal truncated.

Upper part of the head, cheeks, back of the trunk, and the spinous dorsal bright red; the remainder of the fish yellow, with a very broad, irregular, brown band from the axil to the lower half of the caudal. Head and upper parts of the body with scattered irregular small blue spots, most of which are edged with brown; the brown band with large dark-brown spots. Fins immaculate, except the spinous dorsal, which has a few small blue spots.

Freemantle (Australia).

Length $15\frac{1}{2}$ inches.

The nearest ally of this species is *Plectropoma dentex*, Cuv. & Val.;

but the coloration, as represented in the 'Voyage de l'Astrolabe' (Poiss. pl. 4. fig. 2), is so entirely different that we cannot refer our specimen to that species. *Pl. dentex* has been figured for the second time in the 'Voyage of the Erebus and Terror,' pl. 57, from a stuffed specimen in the British Museum. This specimen agrees well with *Pl. Richardsonii* in general form, but its original colours have nearly entirely gone; large round light blotches are still visible on the side of the body, but there is no trace left of the white spots on the back. Whether this specimen belongs to *Pl. dentex* or to *Pl. Richardsonii* is impossible to say; probably it is referable to the former.

January 28, 1862.—Dr. J. E. Gray, F.R.S., V.P., in the Chair.

ON THE SKULL OF THE JAPANESE PIG (*SUS PLICICEPS*).

BY DR. J. E. GRAY, F.R.S., &c.

I have lately had the opportunity of examining the skull of this animal, and now lay before the Society the reasons which induce me to believe that it is a distinct species—and a hitherto undescribed species—of the genus *Sus*, which has as yet only been observed in its domesticated state.

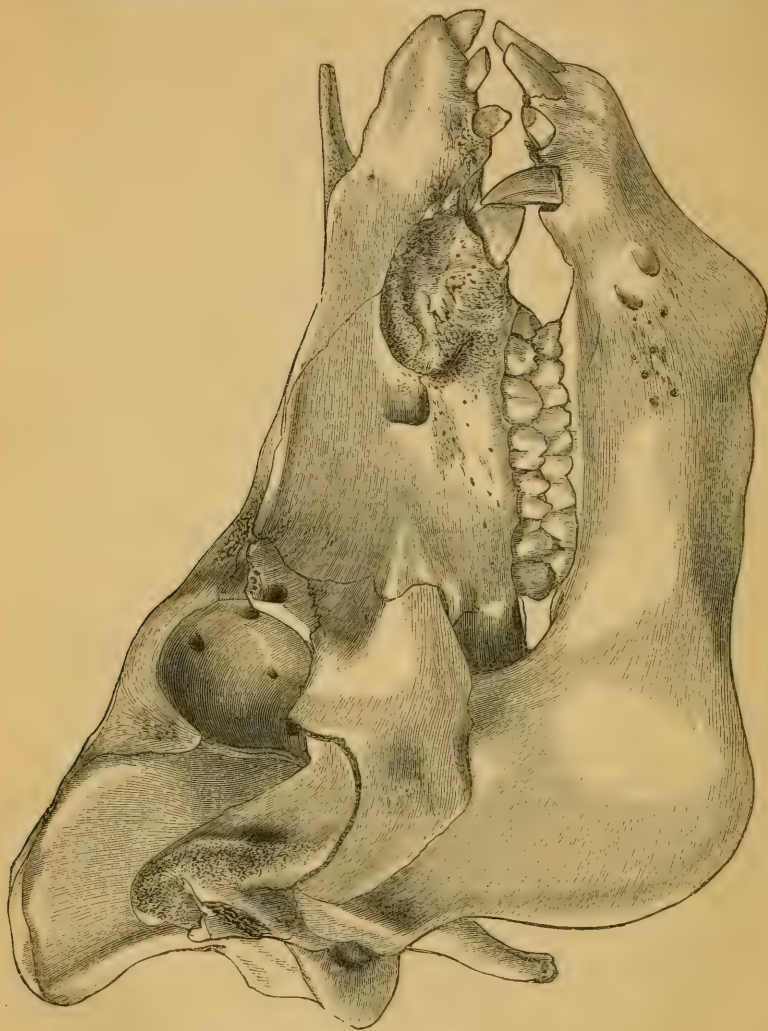
Some time ago, when Mr. Bartlett showed me the Japanese Pig which he had purchased, I was convinced of its belonging to a distinct species, and urged him to send an account of the animal, illustrated with a portrait of its very curious and characteristic face, to the 'Proceedings' of the Society.

The skulls of the domestic varieties of the common Pig, which are bred in Europe, differ but little from the skull of the European Wild Boar.

The skulls of the common domestic Pig, which we have in the British Museum, for example, chiefly differ from the skull of a Wild Boar from Germany in the same collection in being smaller and considerably shorter, and in the angle of the forehead being much more acute and sudden, caused by the back of the two skulls being nearly of the same height, while that of the domestic one is generally much the shortest in length. The position and size of the holes for the blood-vessels and nerves are nearly the same in all these skulls. The underside of these two skulls and the forms of the palates are also very similar. The lower jaws are equally similar. Cuvier, in his 'Ossements Fossiles' (vol. iii. Cochon, pl. 1. f. 1, 2, figure of the skull), well represents the skull of our domestic Pig. Blainville, in his 'Ostéographie des Mammifères' (Genus *Sus*, pl. 14), figures the skulls of three male Wild Boars, and of a male and female domestic Pig, and on pl. 5. two skulls of *Sus indicus*, one from Malabar and the other from Siam, and one of the *Sus vittatus* from Java. These skulls all have very much the same appearance, and bear no relation to the skull of the Japanese Pig under consideration.

The skull of the Japanese Pig chiefly differs from the skull of the Wild Pigs of Europe, India, and Java, above referred to, and from

that of the common domestic Pig, in being shorter, and much higher in front, especially from the greater height of the front of the lower jaw at the gonyx ; in the forehead of the skull being rather concave before the orbits, flattened, and furnished with a sharp-keeled edge on each side, producing a deep concavity on each cheek in front of the orbit ; in the palate being much broader for its length, and the series of the teeth wider apart and rather arched.



Skull of *Sus pliciceps*.

In the height of the front of the skull, in the flatness of the nose in front of the orbit, in the concavity of the cheek, and in the

broadness of the palate, the skull of the Japanese Pig bears some relation to the skull of the *Potamochoerus penicillatus*; but the lateral ridges of the nose are not so dilated, while the skull is higher in front, and the palate is wider in the Japanese Pig than in the same parts of *Potamochoerus*.

In the wild Pigs of Europe, India, and Java, and in the European domestic varieties, the nose of the skull is always narrow and rounded on the sides, and the palate is narrow.

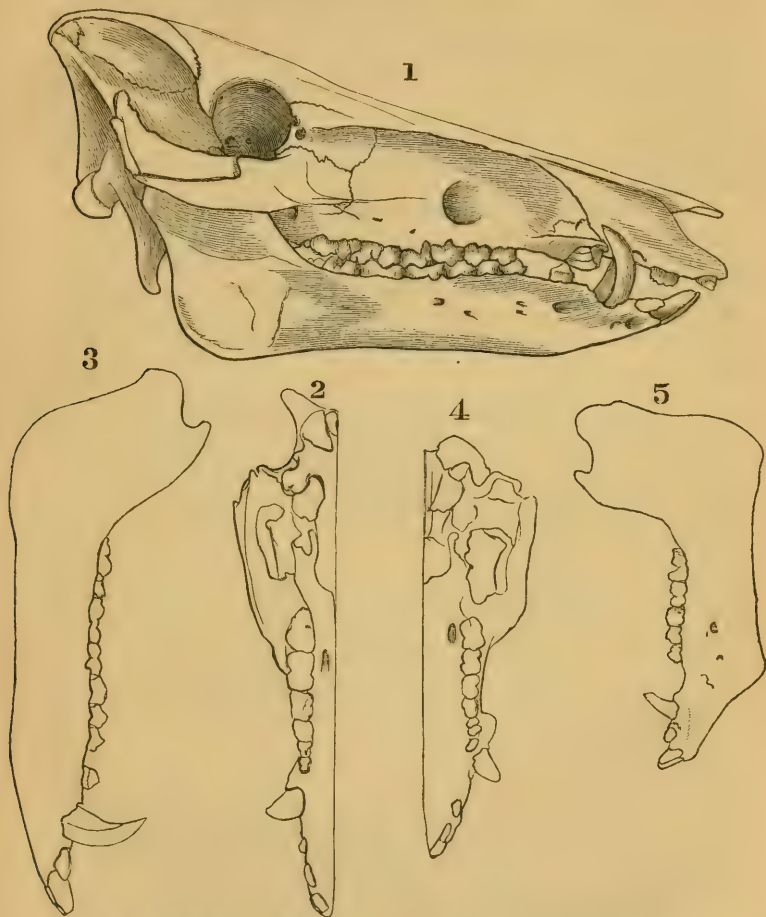


Fig. 1. Skull of *Sus scrofa ferus*.

2. Palate of *Sus scrofa ferus*.

3. Lower jaw of *Sus scrofa ferus*.

Fig. 4. Palate of *Sus pliciceps*.

5. Lower jaw of *Sus pliciceps*.

Under these circumstances, I am induced to regard the Japanese Pig as a distinct type, and propose to call it *Sus pliciceps* until we receive further information respecting it.

We have in the Museum a very large and a moderate-sized skull of the domestic Pig, slightly differing from the others, and from those figured by Cuvier and De Blainville, in the frontal bone being rather depressed and concave in front of the eyes; but we do not know the particular variety to which these skulls belong. Though they agree with the Japanese Pig in these two circumstances, they differ from it and resemble the skulls of the common Pigs and the Wild Boars of Europe and Asia in all other particulars, and show no other character in common with the Japanese Pig, which is also characterized by its peculiarly wrinkled face, well represented in the figures of these animals published in the 'Proceedings of the Zoological Society' 1861, p. 263, and the 'Illustrated News' January 11, 1862, p. 49.

The species at present is only known in its domesticated state. It may perhaps be the descendant of a species found wild in the valleys of the islands.

In both these skulls of the domestic Pigs the lower jaws are rather higher than usual, particularly at the gonyx; and this is especially the case with the largest skull, which is said to be that of an old Boar. Can the size of the lower jaw be a peculiarity of the male sex? We have not sufficient materials to determine this question, either in the Museum or in the plates that have been published of the skull of the genus *Sus*.

I may further observe, there is considerable difference in the occiput between the European and the Japanese Pig; the processes of the back of the palate are much more erect in the Japanese Pig than in the European and Asiatic Pigs, wild and domesticated.

Though I have only described this animal as a species, it evidently forms a section in the genus by itself. The restricted genus *Sus* may be divided thus:—

1. Face smooth, or nearly so; skull conical; the upper part of the nose rounded; palate narrow. *Sus*.

Sus scrofa, *Sus indicus*, *Sus vittatus*.

2. Face deeply and symmetrically furrowed; the skull flattened on the forehead; the upper part of the nose flattened, keeled on the sides; palate broad. *CENTURIOSUS*.

Sus pliciceps.

I regard these facts as very interesting, first, as adding a new kind of domestic animal to our list (and I do not think that any has been added since the introduction of the turkey from Mexico); and secondly, as showing, from a domestic animal, that there must be a wild species which has not yet been brought into our catalogues.

I may observe that, like many other very distinct species of certain genera of domesticated or semi-domesticated Mammalia, as the Horse, Ass, and Zebra, the Ox, the Dog, &c., the fact of interbreeding is no proof that a kind is not a species; for no one would

argue that an Ass and a Horse are the same species, or a Zebra and Quagga, or *vice versa*.

The Japanese Pig breeds with facility with the common domestic Pig. We have not had time to observe whether the offspring is prolific. The half-breed of the Japanese Boar with a common Sow retains almost all the external characters of the male parent well developed. I have not yet had the opportunity of observing what effect the crossing has on the osteological characters of the species.

I think that no one who will take the trouble to compare the skulls of the different varieties of domestic Pigs which are usually found in England, with the skull of the European Wild Boars and the Wild Pigs of Asia and the Island, can doubt for a moment the derivation of the domestic breeds from the wild type*. Indeed, the change in form is so slight as to be scarcely perceptible, and the gradation between the most abnormal form to the wild animal so gradual as to be sufficient to show that even the most abnormal state is due only to a gradual change of form.

Mr. Eyton, in a paper printed in the 'Proceedings,' has shown that a Chinese Pig which he examined had a different number of vertebræ from another domestic Pig; but the skull of a Chinese Pig I have examined shows no characters to separate it from the Common Pig. Its head is a little shorter than usual, but not so short as that of a Berkshire Pig.

MISCELLANEOUS.

On the Arrangement of Natural-History Collections.

By L. AGASSIZ.

[THE following extract from the Report of Prof. Agassiz to the Senate and House of Representatives of the United States will prove interesting as giving the views of a distinguished naturalist upon a subject which has lately given rise to much discussion in connexion with our National Museum. Besides this, it will be found that the questions raised have led Prof. Agassiz to express certain opinions upon palæontological matters which cannot but be regarded as of high importance.]

Having given an account of the general plan of the Museum in a former Report, I propose now to lay before you the plan of the arrangement of that part of the collection which is nearly completed. I deem it the more important to explain it fully, as my experience with other museums has satisfied me that collections of natural history are less useful for study in proportion as they are more extensive.

This may seem paradoxical, yet it is undoubtedly true; for while the most extensive collections answer admirably the purposes of professional naturalists for special researches and original investigations, they are generally beyond the grasp of less advanced students, and

* See Bartlett, Proc. Zool. Soc. 1861, pp. 263, 264; Ann. and Mag. N. H. 1861, 501; 1862, 162.

cease to be instructive at all for the largest number of visitors of such establishments. In arranging our collections, which are intended at the same time to be instructive for the million and to afford the amplest material for any kind of scientific investigations, it has been my aim to combine these two objects; and as nothing of the kind has yet been attempted in any large museum, as far as I know, a detailed account of the plan, as adopted in our Museum, may be welcome to others. But as each class of animals requires a special treatment in a well-appointed museum, I propose, this year, to speak only of the arrangement of the Radiata, as these are the most advanced in our exhibition-rooms.

With the view of fostering the systematic study of these animals and laying before the students in the smallest possible space the best ascertained results respecting their affinities, in the present state of our science, I have arranged special systematic collections, intended solely to exhibit the natural affinities of the members of the several classes. These systematic collections embrace carefully chosen representatives of all the genera; but, with the view of making such collections as compact as possible, only one species of each genus has been introduced from each well-characterized zoological province, frequently to the exclusion of a large number of species which would only bewilder the student in his first attempt to master the natural affinities of the representatives of any given class. With this systematic collection are combined all the preparations intended to illustrate the structural characters of the genera, the peculiarities of form which distinguish the different families, the complication of structure characteristic of the orders, as well as the mode of execution of the structure of the class as a whole.

Next to the systematic collections, I have begun to make special faunal collections, chiefly intended to facilitate the study of the species and their geographical distribution. Thus removing from the systematic collection everything which relates to the study of species, I hope to impress upon our students more forcibly than is generally the case the real importance of a proper investigation of the various degrees and different kinds of affinities which bind all animals into a great systematic whole. These faunal collections have another advantage; they bring distinctly before the eye the character of the inhabitants of different parts of the world in their natural combinations, and that in a far more impressive manner than can possibly be attained by a mere nominative enumeration of species. To add to the interest of these faunal collections, I have placed here everything that may illustrate the peculiarities of the species, and have therefore taken care that they should embrace large numbers of specimens in every possible state of growth. The attempt at arranging these collections has already convinced me of their great importance. Our knowledge of the range of the natural faunæ is very imperfect; and I have found it impossible to adopt, without modifications, any of the proposed divisions of the earth's surface into zoological provinces. The divisions thus far proposed show plainly that they were circumscribed by physical considerations, and not by the special study of

the range and distribution of the animals themselves. However, by the very attempt to place side by side, in a methodical order, all the representatives of adjoining faunæ, I have gradually been led to define more accurately the natural limits of the faunæ themselves. It is surprising to me that the principle by which faunæ may be defined has not yet been stated, although it is very simple. It may thus be expressed : the geographical range of representative species occupying adjoining regions marks the natural boundaries of their respective fauna.

Since in our days it is no longer possible to study the animal kingdom without including in the investigation the remains of past geological ages, the question has naturally arisen, what disposition to make of the fossils. After mature consideration, I have come to the conclusion, that for their most suitable arrangement it was indispensable to make also two kinds of collections of the fossil remains. In one of them, which corresponds to the systematic collection of the living animals, they are arranged systematically, according to the natural affinities of the different representatives of each geological period, in such a manner that the zoological character of these epochs is shown as distinctly to the eye of the student as the character of the present creation, by the study of the systematic collection of the living animals. With the aid of these collections, special zoological treatises of each period may be compiled without difficulty ; and I have already satisfied myself that a comparison of those collections furnishes much information respecting the true affinities of animals.

The second kind of collections of fossils is arranged in a way which corresponds to the faunal collections of living animals,—that is to say, according to their geographical distribution during each successive geological epoch. This arrangement has enabled me to display by themselves the more extensive collections of fossils, obtained from particular localities, in their characteristic mode of association, without crowding them upon the attention of the beginner, or giving them, by their larger number, an undue preponderance in the collection of the epoch to which they belong. But there is another advantage in making special faunal collections of fossils : they suggest comparisons with the faunæ of the present time, which could not otherwise be made so effectively. Thus far geologists, in identifying the horizons of the successive deposits forming the stratified crust of our globe, have started from the universally accepted assumption that animals of the same geological age are either identical or closely allied over the most extensive areas. Nothing can be further from the truth than such a view ; and we need only to compare the faunæ of the present period in remote continents, to see how widely these differ. If the remains of past ages, belonging to the same geological periods, have generally appeared to be identical or closely allied, it is chiefly owing to the fact that they have been collected in the same geographical zones ; and at present we find a similar agreement between the living animals of the temperate zone of Europe, Asia, and North America. But when we pass to other zones, the scene is entirely changed ; and so it was in former ages, as we already know from the

tertiary mammalia of South America and of Australia; and this, I have no doubt, will be found to be also the case for the older formations, within certain limits, not yet ascertained. The specific differences between the remains of the same age, found in deposits remote from each other, are daily brought out more distinctly; and since I have begun to compare the fossils of America with those of Europe, I am gradually led to infer that no specific identity is likely to be established, finally, between animals which have lived at great distances from one another, even though they were contemporaries. The doctrine of the identity of fossils of the same age will therefore require great modifications. I am already certain that species of the same family, belonging to different epochs, but found in corresponding zones of latitude, are frequently much more closely allied than species of the same age belonging to different zones. The time is therefore fast approaching when zoological affinity alone will no longer be a trustworthy criterion of contemporaneity, nor zoological difference, however striking, be taken as evidence of a difference in geological age. This unexpected and probably to many most unwelcome result I have obtained by a careful comparison of many faunæ of past ages, arranged in the manner above indicated. If this should render the identification of rocks, by the aid of the fossils they contain, more difficult for those not very familiar with zoology, it will, on the other hand, afford most instructive evidences of the successive changes the animal creation has undergone upon different parts of the earth's surface, at different periods, and show how, in earlier ages, combinations of living beings existed in certain parts of the globe, quite distinct from those now occupying the same localities, and yet quite similar to those existing at the present time in other regions. I need only allude to the similarity of some of the extinct faunæ of the jurassic period to the living fauna of Australia, to make this statement clear; and similar resemblances may be traced between the extinct faunæ of other periods and the living faunæ of other parts of the world. As one instance already pointed out, on another occasion, I may allude to the resemblance of the extinct fauna and flora of Oeningen with that of the temperate zone of the Atlantic States of North America.

A third kind of collections embraces everything that may illustrate the mode of reproduction, and the embryonic growth of each class. Here are placed together eggs and embryos in various stages of development, and young animals which have not yet completed their growth and assumed their specific characteristics. But these collections do not include the preparations intended to illustrate the organs of reproduction themselves, as characteristic of the different families in the adult state; these are referred to the general systematic collection.

An objection may perhaps be made to such an arrangement of a museum, as requiring a larger number of specimens than are generally exhibited in a systematic collection, embracing in one series the whole animal kingdom. It would certainly be a great mistake to neglect these multiplied modes of instruction, even were it true that they en-

tail the necessity of preserving a larger number of specimens, and may lead to some waste of room. I am satisfied, however, that with a proper attention in the selection of the specimens intended as representatives of the genera in the systematic collection, no unnecessary repetitions need be made. I have been careful everywhere to avoid the introduction of large specimens in the systematic collection, in order to render them more comprehensive, and to bring, at a glance, a whole class under the eye; while the bulk of specimens illustrating the species are referred to the faunal collections. And I need not repeat here what I have stated again and again on other occasions, that the great deficiency of other museums, and especially of the large public collections, consists in the scanty representation of the species and the monotony with which a single male and female, or sometimes even a single specimen, are allowed to be the only provision made for the study of an animal which, to be well known, ought to be examined in an ample series of specimens of all ages, of both sexes, and in every possible state of preservation. What are frequently called characteristic specimens, and paraded singly as types, are but too often thus set aside by unscientific keepers of museums, in order that they may have an opportunity of disposing of other specimens for exchanges, and thus increasing the nominal number of the species in their collections.

On a New Genus of Lizards from Ceylon.

By W. PETERS.

COPHOTIS, nov. gen.*

By its compressed form, the equal number of its fingers and toes, and its concealed tympanum, this genus of *Iguanoidæ* approaches the Ceylonese genera *Otocryptis*, *Lyriocephalus*, and *Ceratophora*. It is readily distinguished from them by the extremely fine granulation and keelless texture of the soles of all the feet, by the nearly equal length of the third and fourth toes, by the comb of scales, which extends along the whole length of the back, by the large scales of the tail, and the more produced form of the muzzle. It agrees most closely with *Ceratophora* by the larger scales on the sides of the throat, the neck, and the body, and with *Lyriocephalus* in its occipital spine and small postocular spine.

Cophotis ceylanica, n. sp.

The head is pyramidal, twice as long as its breadth and height; the muzzle is equal in length to the distance between the eyes. The round nostrils open laterally in simple shields, which stand in immediate connexion with the supralabial shields, and are separated from the rostral shield by one or two, and from each other by three series of convex scales. Regular, keeled scales, pretty nearly equal in size to those occurring on the muzzle, form a supraorbital arch on each side; this consists of seven scales, and applies itself to the post-orbital spine. The supraorbital arches are separated from each

* From *κωφός*, weak; *οὖς*, *ὠτὸς*, ear.

other only by a single row of scales; and the arch is filled up to the supraorbital margin by three or four rows of scales, which decrease in size from within outwards. There are on each side nine supralabial shields, followed immediately by a second row of scarcely smaller shields. The scales of the temporal region are of the same size as those of the fore part of the head; and a few somewhat larger ones show, like the latter, a short point in the middle. The occipital region terminates in two short spines converging as in *Lyriocephalus*. The eyelids are entirely covered with small granular scales; it is only on the margins of the eyelids that they appear to be smooth; and on the upper eyelid there is a row of from three to five rather larger flat scales. The region of the chin and throat is covered with slightly keeled scales, lying in rows parallel to the infralabial shields, and gradually diminishing in size towards the median line. In the upper jaw there is a short one-pointed median tooth, followed upon each side by two equally short ones, then a longer one, and then thirteen three-pointed molars; in the lower jaw the median tooth is wanting, and on each side there are two one-pointed and fourteen three-pointed teeth. The neck, body, and tail are compressed, and the latter, in the two specimens described, is bent downwards (prehensile?). The back and the sides of the neck, trunk, and tail are covered with large imbricated scales, which are particularly large in the middle of the sides of the body; the scales are smallest on the under side of the neck, where there is an inconspicuous gular sac in the smaller of the two specimens, and on the breast; but these are keeled like the ventral scales, which are about one-half larger. On the back of the neck three or four long pointed scales form a crest, which is continued by similar but isolated scales down to the sacral region. The tail has no trace of a dorsal crest, but presents two inferior keels as in *Ceratophora*. The extremities, which appear to be shorter than in the allied genera, are covered, both on their upper and under sides, with large scales, but are strikingly distinguished from those of the allied genera by having the scales of all the foot-soles extremely small, and the soles of the fingers and toes very slightly, if at all, keeled, in accordance with the small size of the scales.

The colour is brown (blue on the spots deprived of scales); from the point of the muzzle a yellowish band runs along the upper lip to the shoulder, where it suddenly becomes broader; an elongated spot behind each eye, a large spot on the nape of the neck, in front of the crest, a large triangular spot with its point towards the back close behind the anterior extremities, and some broad, somewhat indistinct, transverse bands on the tail are yellow. The throat also is yellow, but marked on each side with irregular bands running obliquely from the margin of the lower lip.

Total length 0·136, head 0·018, tail 0·075, anterior limb 0·023, posterior limb 0·027; width of the head 0·008 metre. The two specimens were collected in Ceylon by M. Nietner.—*Monatsbericht der Akad. der Wiss. zu Berlin*, December 1861.

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XLV.—On *Ephedra*.

By JOHN MIERS, F.R.S., F.L.S. &c.

BEFORE I publish my observations on the *Anacardiaceæ*, I wish to offer some remarks on *Ephedra*, for this reason, that the mode in which the ovule is fecundated in the *Gnetaceæ* affords a probable clue to the solution of an enigma in the former family which is otherwise difficult of explanation. My memoranda and drawings from living plants of *Ephedra* were made more than thirty-five years ago, at which period I found several species growing in Chile, in the Cordillera of the Andes and in the neighbourhood of Mendoza, the structure of which excited my particular attention; but, being then a mere tyro in botanical investigations, it never occurred to me to notice the development and growth of its ovary. I have lately repeated my analyses of these plants (now in a dried state), guided by a better knowledge of their organization; but, before I detail the results obtained, I will first quote the opinions of botanists in regard to the structure and affinities of the family, and will then give the reasons upon which my own views are founded.

The family of the *Gnetaceæ*, first established by Blume in 1834, until very recently consisted only of the genera *Gnetum* and *Ephedra*, which are so extremely different in habit that previous botanists had no idea of their close proximity.

Jussieu (in 1789)* arranged *Ephedra* in *Coniferæ*, where, together with *Casuarina* and *Taxus*, it entered into his first section of that family, while *Gnetum* was considered to be more allied to *Urticaceæ*, near *Misodendron*, *Piper*, and some others.

Poiret (in 1808)† looked upon *Ephedra* as allied to *Casuarina* and *Taxus*, but seemed to have had no idea of its relation to

* Genera Plantarum, pp. 411 and 406.

† Diet. vii. p. 276.

Gnetum, in regard to the affinity of which genus he offered no opinion.

Richard (in 1810)* placed *Ephedra* in *Coniferae*, following *Salisburia* in his tribe *Taxineae*; but he made no mention of *Gnetum*.

Mirbel (in the same year)† gave *Ephedra* a similar position: he, too, seemed to ignore the relationship of *Gnetum*.

Robert Brown (in 1814)‡, speaking of *Coniferae*, and referring to the view of Mirbel that the female fructification is a pistillum with a perforated style, observed that this argument "is derived from the genus *Ephedra*, in which both the stigma and a considerable part of the style project beyond this cupula (pericarpium), without cohering with its aperture; and in confirmation of this opinion it may be observed that I have found a projection of the stigma, though certainly in a much less obvious degree, both in *Agathis* and *Podocarpus*." It is evident that this great botanist at that time had a very imperfect knowledge of the real structure of *Ephedra*; for he then considered the pericarp to be a modified disk, and the integuments of the seed to be the pistillum. At a later period, however (in 1825)§, in his celebrated memoir on *Kingia*, remarking upon *Cycadaceae* and *Coniferae*, he corrected his former opinion, having noticed that its supposed style is in reality the elongated tubular apex of the seminal integument.

Blume (in 1834)||, in establishing the family of the *Gnetaceae*, where he first associated *Gnetum* with *Ephedra*, gave a novel and, to my mind, the truest interpretation of the ordinal structure and affinities of this small group: to his opinions I will presently refer. It is to be regretted that his views in regard to the nature of its several structural parts have not been adopted by subsequent botanists, who have greatly mystified the subject by employing different sorts of nomenclature for the several floral and seminal parts, in order to accommodate these expressions to their notion of the close affinity of the *Gnetaceae* with *Coniferae* and *Cycadaceae*, and to the doctrine of naked seeds, as applied to those families.

Dr. Lindley (in 1836)¶ placed the *Gnetaceae* among Gymnosperms, next to *Cycadaceae* and *Coniferae*, but at the same time confessed that, having examined dried seeds of *Gnetum*, he felt inclined to favour the view of Blume, whose opinion he quoted at length, showing that the *Gnetaceae* possess a far higher degree of organization, tending to a much nearer approach to *Casuarina* than to either *Coniferae* or *Cycadaceae*.

* Ann. Mus. xvi. p. 297.

† Gen. Rem. p. 572.

|| Ann. Sc. Nat. 2 sér. ii. p. 101.

† *Ib.* p. 458.

§ Append. King's Voy. p. 64.

¶ Introd. Bot. p. 311.

Endlicher (in 1837)* arranged the *Gnetaceæ* in his class *Coniferæ*, after *Taxineæ*, and, although preferring this position, he admitted their approach to *Casuarina* through *Ephedra*, on the one hand, on account of its aphyllous habit and the structure of its female flowers, and to *Chloranthaceæ*, on the other, through *Gnetum*, because of its fully-developed leaves.

Meyer (in 1846)† published a monograph of *Ephedra*, which he prefaced by an inquiry into the nature of the flowering parts and seminal integuments in *Gnetaceæ*: he there confirmed Brown's later view of the origin of the tubillus, which he showed to be a mere elongation of the micropyle of the inner integument; but he adopted the view of Richard in calling the pericarpial covering of the fruit an "involucellum," although he considered it rather in the nature of a perigonium: he there called the entire fruit a "pseudo-nucula."

Dr. Lindley (in 1846)‡ followed his previous view of the position of the *Gnetaceæ* among Gymnosperms; but he adopted the notion of Griffiths in respect to the pericarpial covering of the seed, which he regarded as one of its proper seminal integuments, adding, "there can be no doubt that in reality *Gnetum* is as truly naked-seeded as conifers themselves."

A very interesting posthumous memoir of the late Mr. Griffiths on the structure and development of the ovule of *Gnetum* was read before the Linnean Society in 1859 §, although a portion of the same appeared (in 1846) in the first edition of Lindley's 'Vegetable Kingdom' (the original memoir bearing the date of August 1835)||. This memoir endeavoured to prove that the ovule of *Gnetum* is naked, that is to say, not contained in a carpel, but enveloped in three or four distinct proper integuments, which, being open at the summit, allow the direct action of the pollen upon the nucleus. That ingenious botanist concluded, from the facts he adduced, that the *Gnetaceæ* are truly gymnospermous, and more nearly allied to *Cycadaceæ* than to *Coniferæ*.

Lastly, Agardh (in 1858)¶, following the opinion of Richard, that the ovule is quite naked, that the inner integument with its tubillus is the true pistillum with its exerted style, and that the outer seminal integument and the pericarp are its persistent floral envelopes, inferred that its naked ovule is a mere embryo-sac, analogous to that of the *Santalaceæ*, and that the *Gnetaceæ* are closely allied to the *Viscaceæ* and the *Loranthaceæ*,

* Gen. Plant. p. 262.

† Mem. Acad. St. Petersb. v. pp. 35-108. 8 tab.

‡ Veg. Kingdom, p. 232.

§ Linn. Trans. xxii. p. 299.

|| Veg. Kingd. p. 233.

¶ Theor. Syst. p. 113.

although analogous to the *Coniferae*, to which *Ephedra* more especially osculates.

We may perceive, from this history, how confused are the opinions of botanists in regard to the structure and to the position and affinities of this small order. This confusion has arisen from the assumption that the ovule in the *Gnetaceæ* is naked; but I can perceive nothing in the structure of *Ephedra* to support this assumption, as the organization of its carpel seems to me quite in accordance with the usual structure of perfect dicotyledonous plants, under some peculiar modifications which are likewise found in families of a very high degree of development. Blume correctly considered the pistillum as an "ovarium," containing a nucleus surrounded by the two usual integuments ("spermoderms"), and the fruit as a "baccate drupe," consisting of a coriaceous "pericarp," containing an albuminous seed invested by two regular integuments. This same female organ was, however, regarded by Richard as an entire flower, the ovarium and pericarp of Blume being, in his estimation, an "involucellum," the outer integument its "calyx," and the inner integument its "pistil" with an "exserted style," the enclosed nucleus and subsequent albuminous mass being considered to be naked, and deficient of any proper integument. Meyer likewise denominated the ovary and pericarp an "involucellum," forgetting that this supposed involucel is at first contained within a petaloid perigonium in *Gnetum* as well as in *Ephedra*; and though he admitted the existence of the two integuments within his "involucellum," he still considered the nucleus and its subsequent albuminous mass as being "naked." Griffiths, on the other hand, regarded the pistillum as a naked ovule, covered by three integuments, thus considering the real carpel as the primine and testa, the outer proper integument of the seed as the secundine, and the inner coating with its tubillus as an accessory integument of adventitious growth. Such are the various self-evident contradictions to which botanists have been obliged to have recourse in order to support their favourite doctrine of the existence of a naked ovule in *Gnetaceæ*.

Ephedra is distinguished from *Gnetum* by the absence of properly developed leaves and by a different form of inflorescence. They are both sparsely spread over both hemispheres, the former generally in temperate latitudes, or within the tropics only at great elevations; the latter genus is only found in torrid regions. *Ephedra* consists of shrubs of small height, ramifying from the root into numerous divided branchlets resembling those of *Casuarina* or *Equisetum*; these are woody, terete, striated, and divided by articulated nodes, each node being surrounded by a short vaginant sheath cleft more or less deeply into two opposite

(more rarely into three equidistant) segments, which form the rudiments of leaves, and it is from the axils of these segments that other branchlets originate. These branchlets are somewhat erect or spreading, and again subdivide in like manner; but the last of them are generally entire, often virgate, though still marked by the usual sheath-bearing nodes, and it is from the latter that the flowers make their appearance. The inflorescence in *Ephedra* is in the form of a short amentiform and often pedicellated spikelet arising out of the nodes just mentioned or at the termination of short axillary branchlets. The flowers are described by authors as either monœcious or diœcious; but in the male spikelets I have generally found, in the terminal involucl between the last two male florets, a single female floret consisting of its own involucl and a small bifid perigonium which encloses two very minute collateral carpels equal to it in length: whether these are the same that produce the fruit, or are sterile ovaries, I have not the means of determining; in either case the spikelets may be said to be polygamo-monœcious. The male spikelet is composed of about six or eight involucls, each of these consisting of two opposite leaflets united at their base into a short vaginant sheath that surrounds the axis; and these involucls, separated by short intervals, are placed decussately over one another, so that the whole assumes the appearance of an amentum of four lines of closely imbricated bracts. Each involucl contains two opposite male florets seated in the axils within these bracteiform leaflets, which are erect, ovate, concave, and of thin texture, but which afterwards grow to a much larger size, and become either scarious or fleshy: each male floret consists of a petaloid perigonium, which is nearly of the length of the involucl, transversely compressed, tubular in its lower moiety, and cleft above into two semiorbicular, erect, concave segments with inflected margins, the posterior lobe overlapping the anterior lobe imbricatively in æstivation; this perigonium is thin in texture, of a pale-yellow or whitish colour, the lower pair of florets becoming caducous before the upper pair open, the persistent leaflets of the involucls increasing gradually at the same time. The stamens are monadelphous, the filaments being united into an erect, flattened, narrow, hollow tube, with nervures corresponding in number to the anthers; it is about half as long again as the perigonium, to the bottom of which it is attached; its exserted summit is flattened, fan-shaped, and of a greenish colour, and bears on the teeth of its margin about six or eight erect crowded anthers, which are sessile or borne upon very short threads; these anthers are subglobular, of a bright-yellow colour, formed of two connate cells separated by a partition without any connective, and opening

by two small pores in the apex, which sometimes run into a transverse fissure. The pollen is spindle-shaped, and longitudinally 8-grooved. I know nothing of the structure of the ovary, not having seen a unisexual female spikelet in the flowering state; no one has yet described it, nor do we meet with it in herbarium specimens until the fruit has attained its full size; the spikelet has then the same number of decussating leaflets as the male flowers, all the lower series being empty. At the time I saw the living plants, I was impressed with the idea that the inflorescence in *Ephedra* is monœcious, that the fruit-bearing spikelets are the same as those bearing male flowers, where the persistent involucels have increased in size and many of them grown thicker, and from which the male florets have fallen away, leaving the solitary terminal male flower finally developed into two ripe carpels. I cannot now be certain of this fact, nor will I attempt to contradict the statement of botanists who consider the flowers to be diœcious; but appearances seem to favour my earlier conviction that the flowers are monœcious in the same spikelets, the terminal flower being developed at a much later period, as often occurs in *Euphorbiaceæ*. In support of this idea, it may be remarked that the flowers in the male involucels are developed successively upwards at different periods; so that before the æstivation of the upper florets the lower ones have fallen away, and their bracts have grown to two or three times their former size, thus resembling the empty imbricated involucels always found supporting the terminal pair of achenia in what are considered female spikelets: this fact may be seen in all herbarium specimens. The male flowers are constantly laterally attached, while the solitary female flower always forms the termination of the axis of the spike. The achenia are ellipsoid, sometimes much acuminate at the summit, flat on their contiguous sides, convex externally; each is terminated by a slender tubular style-like process, of about half its length, which has protruded through a small aperture in the summit of the pericarp, left by the permeable sessile stigma of the ovary. The pericarp is somewhat thick, coriaceous, and of a dark-brown colour, the mesocarpal portion consisting of numerous longitudinal ligneous fibres, closely compacted by scalariform tissue and fleshy matter; it is indehiscent, and contains an erect seed, similar in form to, but considerably shorter than its cell. The seed is covered by two integuments, both of which are thin and membranaceous; the outer one (the testa) is of a darker colour, but paler and diaphanous in its upper free moiety, while its lower half is agglutinated to the inner integument and attached by a thickened and almost stipitate chalaza, which is here confounded with the hilum: it is reticulated and devoid of vessels, is shorter than the inner in-

tegument (tegmen), which it closely embraces, its mouth being quite unclosed. The tegmen, though free in its upper moiety and partly covered by the free portion of the testa, is conical and much thickened in that part, very opaque and white, and often corrugated, being closed in its somewhat attenuated apex by a globular reddish gland ("tuberculus stigmaticus," Rich.), from the concave centre of which rises the tubular style-like process before mentioned, which, after traversing the vacant portion of the cell, passes through the foramen of the pericarp, and generally extends beyond it to a distance of nearly half its length: this process, called a "tubillus," is of the same texture and colour as the upper portion of the tegmen, and is similarly reticulated; so that no doubt can exist that it is an extension of the mouth of that integument, but closed by the formation of a gland at the usual place of the micropyle: the tubillus beyond this is hollow for its whole length, its apex being open and more or less unequally two-lipped. The albumen fills the tegmen, is fleshy, compressed, plano-convex, rounded at its base, but gradually attenuated towards its apex, where it is slender, and sometimes extends beyond the radicle. The enclosed embryo is nearly the length of the albumen, its lower moiety consisting of two compressed cotyledons with nearly straight sides, their faces being parallel to the flat side of the pericarp and to the lobes of the involucrel: the radicle, which points to the summit of the carpel, is nearly as long as the cotyledons, but only a quarter of their breadth, being terete, its outer or epirhizal portion being white and opaque, while its internal or neorhizal part is fleshy, more pointed, apparently of the same colour and texture as the cotyledons, with which it seems continuous; the epirhizal portion is more cellular, like a distinct envelope, often extending beyond the apex of the neorhiza, which is the growing-point of the future root. In the seed of some species of *Ephedra*, where the summit of the inner integument below the micropylar gland is greatly attenuated, and often so much corrugated that it can be further lengthened by force, the upper portion of the albumen becomes also attenuated, and as it extends beyond the point of the radicle, and contracts an adherence with the gland, it looks almost like a short suspensor; but its texture shows that it is only a continuation of the albuminous mass, there being no trace of anything analogous to the suspensor described by Gaudichaud and Griffiths in *Gnetum*. From the above facts, it will be seen that the seed of *Ephedra* is quite atropous, and (if we except the formation of the tubillus) little different in its entire structure from that of many of the *Urticaceæ*.

I have thus detailed minutely the floral and seminal structure of *Ephedra*, in proof of Blume's declaration that the *Gnetaceæ*

possess a much higher degree of organization than any of the so-called Gymnospermous families. This structure of *Ephedra* offers great analogy to that of *Gnetum*, from which it differs in the relative numbers, sizes, and position of the male and female flowers, in the form of its floral envelopes, in the number of its anthers, and in the relative size of the radicle and cotyledons. In *Gnetum* the flowers are arranged in distant nodes, each node consisting of one general, short, cup-shaped involucre, which encircles the stem, and supports two close whorls of numerous florets crowded together, each in a single series, the lower series being composed of female florets, the upper one of male florets: in the female series the perianthium is reduced to lacerated scales that surround each ovary; in the male flowers, which have only a single stamen, each is contained within a 2-4-fid perigonium. I have not seen its fruit and seed, which are minutely described by Griffiths: it grows to a size many times larger than that of *Ephedra*, often attaining the dimensions of a plum, the ovary from which it originated being extremely minute. Analogy shows that each involucre of the spikelet in *Ephedra* is a verticil composed of two opposite bracteiform leaflets standing in front of each perigonium, and which are connate at their base. In *Gnetum*, where, instead of two, more than a score of florets are congregated in each verticil, these bracts become wholly agglutinated together by their margins into an entire cupular and annular general involucre. We find the precise homologues of such gamophyllous involucels in the *Nyctaginaceæ*, *Thymeleaceæ*, *Polygonaceæ*, &c.

No one has yet noticed the condition of the ovary of *Ephedra* at the period of its fructification, nor any of the intermediate stages of its growth into a mature seed; nor has any botanist remarked its different gradations in *Gnetum*, except Griffiths, who, in the posthumous memoir before mentioned, minutely detailed this growth. According to that excellent observer*, the production of the tubillus does not commence till after the impregnation of the nucleus, when the micropylar mouth of the tegmen gradually expands and finally becomes elongated into a narrow open tube, which becomes protruded far beyond the apex of the pericarp, as we find it in *Ephedra*; according to his report, there is at first no constriction in this tubillus, which remains unclosed for the purpose of impregnation, but it afterwards becomes sealed up by a distinct deposit and by the adhesion of the base of the tubillus to the tercine or integument formed by the contraction or absorption of the body of the nucleus, within which the albumen becomes deposited†. The various changes that take place

* Linn. Trans. xxii. 301, tab. 55. figs. 18 & 20.

† Loc. et tab. cit. figs. 21, 24, 26.

during this action (except the lengthening of the micropyle of the secundine) are precisely analogous to those which occur in the fecundation and production of seeds in the higher order of exogenous plants.

In *Ephedra*, if we look upon its style as being entirely reduced so that its hollow stigma becomes in consequence depressed and fixed in the apex of the ovarium, we have nothing in such a case but a modification of the ordinary pistillum; and under this point of view we have no sound reason for giving the name of *gymnospermous* or naked ovules to the germens of the *Gnetaceæ*. In support of the view thus taken, we find here the female organ in its development following the same changes as in some of the higher orders of dicotyledonous plants; for the nucleus of a single erect ovule grows into a regular embryo, enclosed in albumen, its proper integuments (primine and secundine) finally close over the nucleus, and become the testa and tegmen of the seed, while the shell of the ovarium, in the usual manner of phanerogamous seeds, becomes a coriaceous pericarp formed of ligneous fibres (in *Gnetum* intermixed with peculiar acicular pungent crystals, perhaps analogous to the cystoliths of the *Urticaceæ*).

The only circumstance that has favoured the notion of naked ovules in the *Gnetaceæ* is the absence of a style in the ovary, as just mentioned, and the more immediate impregnation of the ovule, by the entrance of pollinic boyaux through the aperture in its apex, without the intervention of any apparent placentary channels. But a very similar mode of impregnation exists in numerous other families, where the style is hollow for its whole length, leaving a pervious opening into the cell of the ovary: this exists in *Styraceæ*, *Olacaceæ*, and many others. Schleiden figures it in *Helianthemum**, where several pollinic boyaux are seen descending through the styles into the cell of the ovary, and fixing themselves upon the micropyle of its several ovules. This fact, though not distinctly seen by Brown, was ingeniously inferred by him a long while before†. Mirbel shows how this is effected in *Statice*‡, where a cylindrical process (probably formed of the usual conducting-tissue combined with pollinic boyaux) descends from the united styles through an aperture in the apex of the cell of the ovary, and fixes itself upon the micropyle of the ovule, by which means it becomes fecundated in the same direct manner as in the *Gnetaceæ*. Griffiths also remarks§ that he could not detect any conducting-tissue in the wall of the

* Nov. Acta Cæs.-Leop. xix. p. 56, tab. 8. figs. 131-133.

† Gen. Remarks, p. 58.

‡ Mem. Acad. Inst. ix. 625, tab. 4. figs. 2, 3, 4.

§ Notulæ, p. 169, pl. 52. figs. 13-20.

ovarium leading from the stigmata to the base of the cell in *Chenopodium*; he saw distinctly, however, pollinic boyaux attached to the micropyle of its ovule, which could have had no other means of ingress into the cell except directly from the base of the very short style. As before mentioned, we find a similar mode of direct communication between the stigma and the ovules in *Olacaceæ* and *Styraceæ*, where the latter are suspended from a free central placenta, or rather ovuligerous column, the apex of which frequently enters into the broad hollow space in the base of the style; by this means the ovules appear to receive the pollinic influence immediately through the open channel of the style. A similar perforation in the apex of the cell of the ovary into the hollow style is seen in all the *Thymeleaceæ*; and this is manifested in *Cansjera*, where the ovules are fixed on parietal carinal projections, leaving open channels which extend nearly to the summit of the style. Griffiths gives other similar instances in *Santalum*, *Osyris*, and *Loranthus*, where he traced* the pollen-tubes from the stigmata, in a direct course through the style into the cell of the ovary, and in contact with the apex of the embryo-sac in the nucleus of the ovule. It was moreover shown long ago by Endlicher†, and since confirmed by Dr. Weddel, in his admirable monograph of the *Urticaceæ*, that in that family the micropyle of its basal atropal ovule attains the summit of its 1-locular cell, where it meets with the stigmatic tissue protruding from an opening in the base of the style, and where it becomes firmly attached, as already related of *Statice*. These are cases perfectly analogous to what occurs in the *Gnetaceæ*, and yet no one has ventured to designate the germs so immediately impregnated in those instances as naked or gymnospermous ovules. So likewise in *Piperaceæ*, Schnitzlein has demonstrated‡ that the ovary of *Peperomia* has an open channel in its apex contiguous to its sessile stigma, and that the micropyle of its erect atropous ovule is found in immediate proximity to that foramen, exactly as in *Ephedra* and *Gnetum*. In *Myrica*, also, a similar structure exists.

In a paper shortly to be published on South-American *Anacardiaceæ*, it will be shown that in every genus I have examined there is always a pervious aperture in the putamen, whether it be corneous, as in *Rhus*, or thin and fragile, as in *Comocladia*,—whence, from the position of the ovules and the absolute want of any placentary communication between the style and the ovule, we must infer either that the means of fertilization of the latter could only have been conveyed through the spiral vessels of the umbilical cord, according to the long-exploded notions of

* Linn. Trans. xix. 173.

† Gen. Plant. p. 283.

‡ Iconographia, pl. 81. fig. 17.

Adanson and Turpin, or that it took place by the direct action of pollinic boyaux which had found their way to the nucleus through the aperture in the apex of the carpel, somewhat in the same manner as happens in *Gnetaceæ*. As in that paper I have quoted the evidence of St. Hilaire regarding the similar mode of impregnation witnessed by him in *Polygonaceæ*, *Chenopodiaceæ*, and other families, I need do no more than allude to them as additions to the mass of evidence here brought together to show that this mode of ovular impregnation is more general than is supposed.

In regard to the remarkable growth of the tubillus in the *Gnetaceæ*, I am able to cite two analogous instances in families of a much higher degree of organization, where the mouth of the tegmen is produced into a long tubular expansion, showing that such expansion is in no way connected with the development of what have been held to be naked seeds. I have already demonstrated its production in the tegmen of the seed of *Halesia*, where the summit of that integument becomes contracted into a slender filamentous tube, which appears like a false suspensor, at the radicular extremity of the seed; here, however, the testa closes over it, so that the tubillus, reflected and free, lies between the two integuments*. The other instance is still more striking, and exists in *Tropæolum*, in which genus the production of its tubillus remains to this day an enigma among botanists. The fact of its occurrence was, I believe, first noticed by Gaertner†, and afterwards by St. Hilaire‡, who considered it to be a suspensor analogous to that of *Cycas*, and the channel through which the aura seminalis was conveyed from the funicle for the fecundation of the ovule. Dr. Giraud, in tracing the development of the ovule of *Tropæolum majus*, and the mode of its fertilization by the impact of the pollen-tube upon the apex of the nucleus, confirmed the observations of St. Hilaire in regard to the production of the tubillus at the micropyle of the inner integument§; he also considered this process to be a suspensor like that of *Cycas*, which he regarded as an expansion of the embryo-sac. Schleiden also demonstrates the same fact||, and attributes its existence to the same origin. Subsequently, Mr. Wilson¶ traced the development of the ovule from its earliest stage to the final growth of the seed: but his account is not free from error; for while he admits the great difficulty of discerning the exact limits of the secundine and embryo-sac, he seems to have mistaken the elongation of the one for that of the other, as

* Contributions to Botany, i. 169, pl. 31. fig. 23.

† De Fruct. i. 380, tab. 79. fig. 1.

‡ Ann. Mus. xviii. 469.

§ Linn. Trans. xix. 164, tab. 16, figs. 5, 6, 7, 8.

|| Nov. Act. Acad. Leop. xix. 54, tab. 8. figs. 120-125, p. 56, fig. 126.

¶ Lond. Journ. Bot. ii. 628, tab. xx. & xxi.

other observers had done before him. The drawings of Schleiden are certainly more correct than those of the latter botanist, as far as my observations extend. In examining the seeds of four Chilean species of *Tropæolum*, I found that this process is not the embryo-sac, which appears to have been absorbed: it may be seen that the extremity of the radicle is covered by a short tubular cap, which is continuous with the inner seminal integument; this cap is formed by the doubling of the tubillus or lengthened neck of the tegmen; and where this tubillus passes through the foramen of the outer integument, the latter closes round it by means of a glandular deposit*, well represented in Schleiden's figures 124, 125, by the letter *a*, and in Wilson's figure 10 by the letter *k*. This reduplication of the neck of the tubillus is caused by the final growth of the tooth-like wings of the cotyledons, which, extending themselves upwards, conceal the radicle; and we have proof that the process here alluded to is really a reduplication of the tubillus, from the fact that at this part it is of greater opacity, and that when it is immersed in water under the microscope, air-bubbles are clearly discernible between the doubled membrane of the tube. It is certainly not a continuation of the apex of the radicle, as St. Hilaire imagined, and does not offer any degree of analogy to the suspensor of *Cycas*: the extremity of the radicle is defined by a distinct rounded polished point, its apparent suspensor forming a lax covering around its apex. The subjoined figure 1 shows the form of the

Fig. 1.

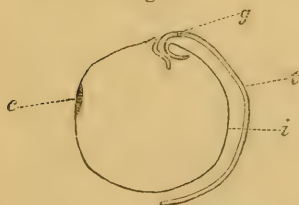
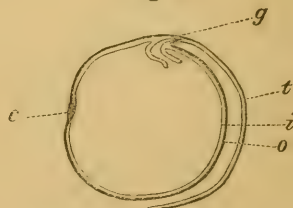


Fig. 2.



inner integument, where its mouth becomes extended into a very long neck or tubillus, which at the point of its origin becomes plicated by the prolongation of the auricles of the cotyledons, thus forming a sort of cap over the point of the radicle: this neck (bearing somewhat the appearance of a suspensor) is the length of half the periphery of the seed, and is reflected downwards from the vertex along the dorsal side, where it lies tightly pressed, but free, between the testa and pericarp: the glandular deposit marked *g* closes the integuments at the point

* This is analogous to the glandular closing of the base of the tubillus in *Ephedra*, which Richard calls a "tuberculum stigmaticum."

where the tubillus (*t*) passes through the foramen of the testa: the position of the chalaza is shown at *c* (near the base of the free portion of the style, and where it is confounded with the hilum). It will hence be seen that the integuments are atropous (not anatropous, as generally believed), while the embryo, from its very excentric growth, lies amphitropously in regard to them*. In figure 2 is seen the same inner integument as in the preceding figure, where it is marked *i*, to which is added the outer integument, or testa, marked *o*, the mouth being closed by the gland *g*, which also forms a stricture in the neck of the tubillus. The analogy of this development with that I have described in *Ephedra* is very manifest.

I have not been able to find in the seeds of *Ephedra* any indication of the long spiral suspensor which in *Gnetum* is described as being coiled up in the summit of the albumen, and there attached to the embryo. The nature of this suspensor has not yet been precisely ascertained: it is figured and described by both Gaudichaud† and Griffiths‡, the former from an analysis of Aublet's Guiana plant, the latter from the examination of two Indian species: there is a considerable difference in the details of these analyses, which admit of conciliation. Its existence in the earliest stage is shown by Gaudichaud (*loc. cit.* tab. 1. fig. 14), where a number of distinct, loose, slender, inarticulate tubes are seen in the summit of the nucleus, which he conceived to be either "very elongated cells" or "embryo-bearing pollen-tubes" (*loc. cit.* p. 54). The next state is represented in pl. 6. fig. 40, when it seems like a long spiral cord in the cavity of the albumen, bearing a very young embryo. Afterwards (in figs. 41 & 42) it appears like a broad cylinder, consisting of the former suspensor, now filled with and surrounded by cellular tissue; and he conceived§ that it was formed by a combination of all the first-mentioned sterile embryoniferous threads. Finally (in fig. 43), we see the same apparent cylinder separating by the application of force into a spiral cord, formed of "des sortes de vaisseaux fasciculés rameux et tissu cellulaire." Griffiths says of it (*loc. cit.* p. 304), "To the upper portion and to one side of the cavity (in the albumen) is attached the embryo by means of an enormously long, tortuous, and spirally but irregularly twisted cellular funiculus, the cells being very much elongated and

* It would involve too long a digression to describe here the very anomalous seminal structure of *Tropæolum*, which has been altogether misunderstood.

† Rech. Organ. p. 76, tab. 1. fig. 14; tab. 6. figs. 40-43.

‡ Linn. Trans. xxii. 304-308, pl. 56. figs. 30-37.

§ "Il est à croire que tous ces cordons stériles (pl. 1. fig. 14) font parties de ce cordon suspenseur."

twisted; its length varies, when moderately pulled out, from $3\frac{1}{2}$ to 5 inches, the length of the fruit being 1 inch. This funiculus, as well as the extremely similar one in *Cycas*, has the property of contracting when immersed in water; when *in situ*, it is tolerably closely packed: it is dilated towards its attachment with the embryo."

From Gaudichaud's account we may infer that this suspensor is composed of cellular tissue loosely compacted round bundles of very elongated pollen-tubes which become spirally twisted into a hollow cylinder, moulded into the size and shape of a cavity of the albumen. Griffiths's drawing seems to confirm this; for when drawn out into a spiral thread, it appears like a bundle of such tubes. From its absence in Brongniart's elaborate analysis of *Gnetum Gnemon**, we may infer that it is not a constant or essential feature in the organization of the seed. Roxburgh, who minutely describes the structure of the embryo in two species of *Gnetum*, makes no mention of any such suspensor; and Griffiths affirms the "very rare and partial development of the funiculus;" for, after examining abundance of fully-formed fruits of two species, he found only two instances where its partial formation, it lying loose in the cavity of the albumen, was observable (*loc. cit.* p. 302). Some additional light will be thrown on this subject in the following remarks.

It has been the general opinion of botanists that the *Gnetaceæ* are intimately allied to the *Coniferae* and *Cycadaceæ*, some inclining to their affinity with the former, others to the latter group, which two families are placed by Endlicher widely apart in his systematic arrangement; while others, again, congregate the three families into one class, *Gymnosperms* or *Gymnogens*. The principal argument in support of the relation to *Coniferae* has been founded on the assumption that in the *Gnetaceæ* the seeds are naked—a doctrine which, it appears to me, ought never to have been applied to this family. In other respects there is no analogy; for the *Coniferae* have a very different habit and another system of inflorescence, which is amentaceous, with achlamydeous flowers and pistils generated upon the under side, or on the margin of phylloidal bracts, forming altogether a development of the lowest grade among dicotyledonous plants. In *Ephedra*, on the contrary, we have regular spikelets of flowers, though small, consisting of opposite decussating involucels, with a perfect petaloid perigonium seated on each axil. There is absolutely no parallelism in the organization of these two families. Most botanists have considered the position of the *Gnetaceæ* among *Gymnosperms* to be close to *Taxineæ* (a suborder of *Coni-*

* Voy. Coq., Bot. vol. ii. tab. i. figs. 6, 7, 8, 9, 10, 13, 14, 15.

fera). In *Taxus*, however, if we consider the outer coating of its pistil to be a carpel, which grows into an ossaceous shell, then its ovule is perfectly devoid of any integumentary envelope, as in *Pinus*, and in like manner it produces a perfectly naked seed*; and, according to the masterly analyses of *Taxus* by Mirbel and Spach†, the facts of which have been confirmed by Schleiden, its ovule has constantly three foramina in its apex, leading into as many embryoniferous cavities in the amnios, after the manner of other true *Conifera*. This is perfectly at variance with all that we find in the *Gnetaceæ*.

With the *Cycadaceæ* the dissimilarity in these respects is still more striking. The existence, however, of a suspensor in its seeds has greatly favoured the idea of the close affinity of *Gnetum* with this family: the coincidence is unquestionable; but this circumstance is of little import upon its own merit, for we may conceive the possibility of its occurrence, as we find it in *Gnetum*, in any family of the highest order of development. The growth and structure of the seed in *Cycadaceæ*, as demonstrated by Miquel‡, present many peculiarities of which we have no parallel in the *Gnetaceæ*. If we regard in its proper light the outer covering of the pistil, and the thick fleshy and coriaceous shell of the seeds of the *Cycadaceæ* to be the growth of a true carpel, it will be evident that the erect nucleus enclosed within the pistil and the seed contained within the carpel are deficient of any proper integument; and under this point of view both may be considered to be perfectly naked—a condition widely different from that of the *Gnetaceæ*, where both the ovule and seed are covered by two distinct integuments. Miquel, who considered the pericarpial covering of the fruit to be the testa of the seed lined with an adherent inner integument, notices that the latter in its early stage is crowned by a broad areolar callus, which he calls its chalaza; this is marked by a circular ring of perforations, which open into as many small cavities, in each of which is generated a distinct thread, coiled up and bearing at its lower extremity an embryo-sac: all these sacs descend into the amniotic body, where only one of them is fertilized; this fertilized sac finds its way out of the amnios into the body of the nucleus

* From the analysis of *Torreya taxifolia*, as given by Sir Wm. Hooker (Icon. 232, 233), it would seem that its carpel is at first pervious at its summit, and is furnished with an erect atropous ovule, provided with two very distinct free integuments, of which the primine afterwards becomes agglutinated to the carpel in the fruit, while the secundine remains coherent with and enters deeply into the plicatures of the ruminated albumen. Should this analysis of the ovary be confirmed, it would show that *Torreya* cannot belong to *Taxineæ*, but is more allied to *Myricaceæ*.

† Ann. Sc. Nat. 2 sér. xx. 257.

‡ Ann. Sc. Nat. 3 sér. iii. 193, pl. 8.

and becomes an embryo, when a mass of albumen is generated around it, which completely encases it, pushing upwards in its growth the persistent amnios, which, like a vitellus, remains as a sort of cap upon the albumen. When the seeds attain maturity, the thread of the fertile embryo, as well as the several filaments still bearing their sterile sacs, all having descended into the vitellus, there become twisted together and surrounded by lax cellular tissue, thus forming the suspensor. This development is clearly shown in its several stages *loc. cit.* pl. 8. figs. 3, 5, 15, 16, 21, 26. After the perfection of the embryo within the albumen, the radicle grows upward, as if germinating, and, forcing a passage through the vitellus, finds an exit by the side of the attachment of its own suspensorial thread, and remains there naked and quite distinct from the main suspensor (as shown in fig. 17)—a fact claiming our especial notice, as it is a condition very different from what Griffiths and Gaudichaud show of the suspensor in *Gnetum*, where the amnios, having been altogether absorbed, the suspensor appears continuous with the radicular extremity of the embryo. In regard to the nature and origin of the several threads (which together form the suspensor), Miquel was evidently inclined towards the notion that they are the pollen-tubes, which had penetrated the several embryo-sacs, becoming afterwards agglutinated together by lax cellular tissue into one general twisted cord: this is certainly the only legitimate inference from all the circumstances recorded, in support of which Griffiths relates (*loc. cit.* p. 306) that he always found in *Cycas* that “the tubular membranous portion of the apex of the nucleus becomes actually crammed with pollen-granules, from the lower and outer of which pollen-tubes are pretty generally produced.”

Changes very similar in their nature take place in the production and growth of the suspensor in the *Coniferae*, the several stages of which were clearly described and figured by Brown two years prior to the publication of Miquel's researches on *Cycadaceae*; and the singular coincidence of these developments is a strong argument in favour of the near affinity of these two families. Brown showed that, in *Pinus** (which, like *Cycas*, is always polyembryonous), previous to the development of the several embryo-sacs and their suspending threads, the former are constantly first discernible in distinct areolar cells in the nucleus, arranged, as in *Cycas*, in a circular series in the summit of the amniotic body: these sacs descend, each separately suspended by its own elongated thread; but generally only one of them becomes fertilized. The further progress of this growth, and the

* Ann. Sc. Nat. 2 sér. xx. p. 195, pl. 5; Ann. Nat. Hist. xiii. 368, pl. 7.

increment of the embryo, which becomes surrounded by an albuminous mass that pushes upward the amniotic body, and remains persistent on it like a calyptriform cap, is quite analogous to the growth described by Miquel in *Cycadaceæ*, and very different from that of *Gnetum*. It is remarked by Brown that each suspending thread appears formed of about four simple tubes connected together but slightly, for he found them easily separable from one another without laceration of their surfaces; and this fact gives additional force to the conclusion before mentioned regarding the nature and origin of the suspensor. Still further evidence is given by Schleiden, who traced the entrance of pollen-tubes into the areolar cavities before described, and into the embryo-sacs, with which they remained permanently connected. The growth and development of these several embryo-sacs in each ovule, and their attachment to suspending threads in *Pinus*, *Thuja*, and *Taxus*, are minutely described and figured in the interesting researches of Mirbel and Spach*, published about the same time, and confirming all the observations of Brown: they describe also each suspending thread as being formed of five or six boyaux or simple tubes agglutinated together, each being hollow and filled with granular fluid or such fovillæ as are usually found in the boyaux of pollen.

[To be continued.]

XLVI.—*Brief Diagnostic Characters of new Canarian Coleoptera.*

By T. VERNON WOLLASTON, M.A., F.L.S.

THE following short diagnoses of Canarian Coleoptera are merely provisional, and are intended to secure a few of the more interesting species, the full details of which (structural and geographical) will be given in the general Catalogue which I am now preparing of the Coleoptera of that archipelago. But as the latter is a work of considerable time and labour, and as a large portion of my material has already been dispersed in European collections, it is almost too much to expect that a certain percentage of the new forms (the descriptions of which have long been completed) would not be anticipated were I to delay the publication of them until my whole manuscript is ready for the press; under these circumstances, therefore, I feel that the subjoined notices, however brief, will serve my purpose in preventing, thus far at least, a too violent intrusion into my Atlantic province.

* Ann. Sc. Nat. 2 sér. xix. pl. 8, 9, 10, 11.

Fam. Carabidæ.

Genus LICINUS.

Latreille, Gen. Crust. et Ins. i. 199 (1806).

1. *Licinus Manriquianus*.

L. ater, nitidus; capite leviter punctato; prothorace transverso-subquadrato (ad latera subrecto), in disco leviter et parce sed versus latera et basin dense et profunde punctato; elytris profunde punctato-striatis, interstitiis convexis, parce et profunde punctatis necnon punctulis minutissimis interspersis; antennis ferrugineis, ad basin, palpis tarsisque rufo-piceis.

Long. corp. lin. $5\frac{1}{2}$ – $6\frac{1}{2}$.

Habitat Lanzarotam et Fuerteventuram, sub lapidibus, tempore hiberno et vernali haud infrequens.

Genus BROSCUS.

Panzér, Ind. in Fna Germ. i. 62.

2. *Broscus rutilans*.

B. ater; capite prothoraceque nitidissimis, hoc angusto, cordato, ad basin profundius et densius punctato, ad latera ipsissima angustissime marginato subconcolore; elytris nitidis, obsoletissime subpunctato-striatis, ad latera ipsissima angustissime marginatis subconcoloribus; antennis fusco-piceis, articulo primo testaceo-piceo; pedibus piceis.

Long. corp. lin. 7–8.

Habitat in montibus excelsis Teneriffæ, usque ad 7000' s. m. ascendens.

Genus POGONUS.

Déjean, Spec. des Col. iii. 6 (1828).

3. *Pogonus Grayii*.

P. angustus, pallidus; capite prothoraceque rufo-testaceis, hoc elongato, postice paulo angustiore, ad basin punctato; elytris testaceis, parallelo-oblongis, subpunctato-striatis; antennis rufo-testaceis; pedibus testaceis.

Long. corp. lin. $1\frac{2}{3}$ –2.

Habitat Lanzarotam, in locis salinis a Dom^o Gray (cujus in honorem nomen triviale proposui) primo detectum.

Fam. Dytiscidæ.

Genus HYDROPORUS.

Clairville, Ent. Helv. ii. 183 (1806).

4. *Hydroporus Clarkii*.

H. oblongo-ovalis, convexus, supra testaceus, oculo fortiter armato subtilissime pubescens; prothorace brevi, ad latera æqualiter ro-

tundato, postice in medio valde producto necnon utrinque macula transversa (in marginem nigrescentem posticum rare suffusa) ornato; elytris ovalibus, lineis nigris valde fractis (antice præsertim abbreviatis) ornatis, utroque punctorum seriebus tribus impresso necnon ante apicem denticulo minutissimo armato.

Long. corp. lin. 2-2 $\frac{1}{4}$.

Habitat in aquis Fuerteventuræ, vulgaris: species in honorem Rev. Domⁱ Clark dicata.

Fam. *Thorictidæ*.

Genus *THORICTUS*.

Germar, Silb. Rev. Ent. ii. 2. 15 (1834).

5. *Thorictus canariensis*.

T. oblongus, rufo-piceus, nitidus, minutissime et parce punctulatus, subtilissime (oculo fortiter armato) cinereo-pubescens; prothorace convexo, ad latera valde rotundato, angulis ipsis posticis oblique impresso-marginatis; elytris piceis, antice subparallelis, in disco valde convexis, ad basin linea media vix terminatis sed utrinque breviter longitudinaliter subcostatis; pedibus brevibus.

Long. corp. lin. $\frac{3}{4}$ -vix 1.

Habitat insulas omnes Canarienses, sub lapidibus in formicarum nidis hinc inde parum vulgaris.

6. *Thorictus gigas*.

T. quadrato-oblongus, rufo-piceus, nitidus, minute et parce asperato-punctatus, subtiliter fulvescenti-pubescens; prothorace brevi, transverso, in disco postico convexo, ad latera valde rotundato dilutius vix subpellucido, angulis posticis obtusis; elytris piceis, ad humeros calloso-incrassatis et ibidem obtuse prominentibus, in disco valde convexis, ad basin ipsissimam linea media sinuata terminatis, necnon utrinque breviter longitudinaliter bicostatis; pedibus longiusculis.

Long. corp. lin. 1 $\frac{1}{4}$ -vix 1 $\frac{1}{2}$.

Habitat Canariam Grandem, in formicarum nidis rarissimus.

Fam. *Buprestidæ*.

Genus *ACMÆODERA*.

Eschscholtz, Zool. Atlas, i. 9 (1823).

7. *Acmaodera Cisti*.

A. elongata, subconvexa, nigra, subtus cinereo pilosa; capite prothoraceque submetallicis, subnitidis, profunde et dense punctatis et pube longiuscula (præsertim in illo) suberecta cinerea fulvaque obsitis, hoc leviter canaliculato; elytris flavo multivittatis, profunde striato-punctatis, interstitiis minute uniseriatim punctulatis.

Long. corp. lin. 2-3 $\frac{1}{2}$.

Habitat Canariam, Teneriffam, et Palmam, præsertim ad flores *Cis-*
31*

torum (sc. *C. monspeliensis* atque *vagantis*) in excelsioribus crescentium.

Fam. Elateridæ.

Genus COPTOSTETHUS.

Woll., Ins. Mad. 238, tab. iv. f. 8 (1854).

8. *Coptostethus globulicollis*.

C. niger, elytris rarius dilutioribus, subcinereo pubescens; prothorace convexo, basi angustato, antice lato, prosterno antice deflexo; elytris convexis, pube subdemissa tenui vestitis, ad humeros oblique truncatis, sat profunde crenato-striatis, interstitiis subconvexis; antennis pedibusque subgracilibus, infuscato-testaceis, illis interdum etiam subnigrescentibus.

Long. corp. lin. $1\frac{2}{3}$ – $2\frac{1}{2}$.

Habitat sub lapidibus in montibus excelsis Teneriffæ, a 3500' usque ad 8000' vel 9000' s. m. ascendens.

Fam. Cleridæ.

Genus CORYNETES.

Herbst, Käf. iv. 148 (1791).

9. *Corynetes fimetarius*.

C. nitidus, pilis erectis mollibus et (præsertim in capite prothoraceque) elongatis ubique vestitus; capite prothoraceque læte cupreis, dense et profunde punctatis; scutello cupreo-viridi; elytris cyaneis, valde profunde seriatim rugoso-punctatis; antennis nigris, basin versus vix dilutioribus; pedibus nigrescentibus, tarsis dilutioribus ad basin testaceis.

Long. corp. lin. $1\frac{1}{3}$ –2.

Habitat Lanzarotam et Fuerteventuram, in stercore arido (sc. bovino, equino, camelino, nec humano), tempore vernali haud infrequens.

Fam. Bostrichidæ.

Genus DINODERUS.

Stephens, Man. Brit. Col. 203 (1839).

10. *Dinoderus brunneus*.

D. cylindricus, piceo-brunneus, fere opacus, ubique densissime et grosse rugoso-asperatus, breviter et parce sed in limbo longius fulvo pubescens; prothorace antice subangustato et valde mucronato, postice dense granulato truncato; elytrorum granulis magnis sed vix subseriatim dispositis; antennarum clava tarsisque paulo magis testaceis.

Long. corp. lin. 2 – $2\frac{1}{3}$.

Habitat in pinetis Teneriffæ et Palmæ, truncos *Pini canariensis* antiquos destruens.

Fam. *Tomicidæ*.

Genus *TOMICUS*.

Latreille, Hist. Nat. des Ins. iii. 203 (1802).

11. *Tomicus nobilis*.

T. cylindricus, piceo-niger, subnitidus, pilis tenuibus longissimis erectis fulvescentibus præsertim in limbo obsitus; prothorace elongato, postice profunde punctato, antice valde asperato; elytris picescentioribus, profunde punctato-striatis, ad apicem subito et valde retusis, parte excavata dentibus lateralibus tribus (superiore maximo noduliformi), uno parvo antico et duobus vel tribus obscuris subconfluentibus posticis, utrinque armata; femoribus tibiisque rufo-ferrugineis, tarsis antennisque rufo-testaceis.

Long. corp. lin. $1\frac{1}{2}$ –2.

Habitat Teneriffam et Palmam, in iisdem locis ac præcedens et una cum illo degens.

Fam. *Curculionidæ*.

Genus *CLEONUS*.

Schönherr, Curc. Disp. Meth. 145 (1826).

12. *Cleonus Jekelii*.

C. cylindricus, niger, cinereo pubescens; rostro triangulari densius pallido pubescente, in medio leviter carinato; prothorace subconico, dense et minute punctulato et punctis majoribus perpaucis adsperso, ad latera pallido pubescente; elytris vix latioribus, parallelis, grosse striato-punctatis, interstitiis obscure pallido pubescentibus (linea suturam versus fracta, maculas parvas efficiente), utroque ad apicem ipsissimum paulo divaricato et longe ante apicem macula media paulo distinctiore albidior ornato; antennis ad basin rufo-piceis.

Long. corp. lin. $3\frac{1}{3}$ – $5\frac{1}{2}$.

Habitat Lanzarotam, Fuerteventuram et Canariam, sub lapidibus in locis inferioribus aridis hinc inde haud infrequens. Nomen triviale in honorem Domⁱ H. Jekel, Parisiis, Curculionidum scrutatoris oculatissimi periti, proposui.

Fam. *Chrysomelidæ*.

Genus *PSEUDOCOLASPIS*.

Laporte, Hist. Nat. des Ins. Coléopt. ii. 514 (1840).

13. *Pseudocolaspis obscuripes*.

P. obscure ænea, grosse sed breviter argenteo pubescens, dense et sat profunde punctata; antennis nigrescentibus, ad basin vix dilutioribus; pedibus subæneo-nigris.

Long. corp. lin. $1\frac{2}{3}$ –vix 2.

Habitat in montibus excelsis Canariæ Grandis, ad flores *Cistorum* (sc. *C. monspeliensis* et *vagantis*) capta.

14. *Pseudocolapsis splendidula*.

P. læte æneo-cuprea, grosse sed breviter argenteo pubescens, dense punctata; antennis longiusculis, rufescentibus, apicem versus plus minus obscurioribus; pedibus rufescentibus.

Long. corp. lin. $1\frac{1}{2}$ –2.

Habitat in Canaria, Palma et Hierro, ad flores *Cistorum* in locis inferioribus et subinferioribus degens.

Fam. Ulomidæ.

Genus HYPOPHLEUS.

Fabricius, Skrivt. af Nat. Selsk. (1790).

15. *Hypophlæus nocivus*.

H. subcylindrico-linearis, rufo-ferrugineus, parum nitidus; capite prothoraceque sat dense punctulatis, hoc convexo elongato-subquadrato, antice et postice æqualiter (sed vix) angustiore; oculis magnis, obliquis, nigris; elytris parallelis, parcius leviusque punctulatis, obsoletissime (vix perspicue) substriatis, ad apicem truncatis, pygidium haud tegentibus; antennis brevissimis, crassis, fusiformibus; pedibus rufo-testaceis.

Long. corp. lin. $1\frac{1}{2}$ – $1\frac{2}{3}$.

Habitat in pinetis Teneriffæ et Palmæ, arbores emortuas antiquas perforans.

XLVII.—*Notes on the Possibility of the Embryos of the Guinea-Worm and so-called "Fungus-Disease" of India, respectively, entering the Human Body through the Sudorific Ducts.* By H. J. CARTER, F.R.S.*

IN my "Observations on *Dracunculus*," published in the 4th Number of the 'Transactions' of the Society (New Series)†, I have stated, at page 217, that the young Filaridæ of the free species, which abound in the Island of Bombay during the "rains," and throughout the year in most of the tanks, "might pass into the human body through the skin direct, or indirectly through the ducts of the sudorific glands, the latter being much larger in calibre (viz. 1-1200th of an inch) than these young Filaridæ,"—assuming that *Dracunculus*, when fully developed in the human body, is a monster-growth of a worm whose natural habitat is out of the body, that the young ones which it then brings forth are too delicate to maintain an independent existence, and thus unable to propagate the species, and that, therefore, the Guinea-worm is introduced.

No case, however, has yet occurred where a young *Filaria* of

* Communicated by the author, having been read in part before the Medical and Physical Society of Bombay on the 5th of October, 1861.

† Ann. & Mag. Nat. Hist. ser. 3. vol. iv. pp. 28, 98.

the free species has been found entering, or in, one of the sudorific ducts; so this is still an assumption; but having met with an instance in which young Filaridæ were found entering a fungus by analogous apertures on the surface, even smaller than those of the sudorific ducts, it seems desirable that the facts should be recorded to show that, at least in the vegetable kingdom, this kind of entrance takes place.

I have formerly stated that the free microscopic Filaridæ chiefly frequent the gelatinous Algæ for breeding, and also for food; and now I can add that myriads also accompany almost every species of large fungus for the same purpose. The number of microscopic worms, together with the larvæ of insects, to which the fungi give nourishment is incredible; and it was on the surface of a large species of *Sphæria* that I observed the fact to which I have above alluded, and of which the following is a description:—

While examining some specimens of the large digitiform *Xylaria* which grows on the decaying trunks of Tamarind-trees, &c., some delicate, glistening, thread-like bodies were seen to project from the summits of the conceptacles (one from each), and to be waving with such an animal motion that I thought it desirable to ascertain their real nature; so, having collected two or three on the point of a needle for this purpose, they were transferred to a little water on a glass slide, and placed under a microscope, when they were found to be young Filaridæ, but too undeveloped for their species to be determined.

The conceptacles are little globe-shaped sacs, imbedded in and scattered over the surface of the fungus, upon which they open by minute mouths or ostioles, respectively, which, when measured, were found not to exceed the 1-1880th part of an inch in diameter (so that they are smaller than the orifices of the sudorific ducts of the human body); and from each of these ostioles was projecting a single *Filaria*—the head in the conceptacle.

If, then, it be possible for these little embryo-worms to enter such small apertures for food in one organic being, it may fairly be inferred that others may do so in another; and hence the possibility, if not probability, of the Guinea-worm in the human subject being a monstrous development of a particular species of one of the free Filaridæ, which also enters the human body in an embryonal form for food, through the sudorific ducts—assuming, as before stated, that, indeed, which is almost a certainty, viz. that the young of *Dracunculus* are too delicate to maintain an independent existence, and therefore cannot propagate the species, which must thus obtain its perpetuity and come from some other source.

(Turning to another subject.—To those who are interested in seeing how the fungi follow in their propagation the law of all other organized beings, the species of *Xylaria* to which I have above alluded may form a beautiful example; for it presents on its surface conceptacles of two kinds, viz. one (the female) bearing thecae filled with sporidia, and the other (the male) bearing a bunch of filaments surmounted by spermatia or conidia. It is necessary, however, not to confound this *Xylaria* with another species of *Sphaeria* which often accompanies it, viz. an *Hypoxyton*. The former is brown when fresh, dentiform, digitiform or clavate, with no definite internal structure; the latter blackish brown, globose, convex, and sessile, presenting a concentric laminated structure internally, and throwing off a dark-black, indigo-blue powder when mature, which consists of the sporidia. Both may exceed in size the fingers and the fist respectively.)

“*Fungus-Disease.*”—Again, the black fungus described by my namesake (Dr. H. V. Carter) in the last number of the ‘Transactions’ (No. VI.), which commits such devastation in the bones and soft parts of the feet and ankles almost exclusively, and ultimately attains, in spheroidal masses, the diameter of half an inch, may also, in an embryo state, that is, in the form of a zoospore, like an *Amæba*, enter the body through one of the sudorific ducts; for microscopic examination of fresh, young and favourable specimens of this undoubted fungus has led me to infer that it is most nearly allied to the Mucorideæ, ex. gr. *Mucor stolonifer*, Ehr. (the black-headed, pin-shaped fungus that grows over paste), which we shall presently see is most probably propagated in this way. This *Mucor* is closely allied to *Achlya*, which has been viewed by some as merely an aquatic form of it, so much are the two alike (ex. gr. the fungus which grows out from dead grasshoppers and insects generally when undergoing decomposition in water). Closely allied to *Achlya*, again, are the “water-fungi” which grow in and out through the cells of all *Algæ*, to which I have long called attention in the Characeæ, &c. (Ann. and Mag. Nat. Hist. 1856), and which lately have been named by Pringsheim “*Pythium*” (Ann. des Sc. Nat. t. xi. p. 370, Bot. 1859): ex. gr. *Pythium entophyllum*, which breeds in and about the cells of *Spirogyra* after the latter has been removed from its habitat, and kept in a basin of water until it begins to perish. Lastly, all these are allied to the great fungus family of Myxogastres, for which now the name of “Myxozoa” has been proposed by M. Antoine de Bary (Ann. des Sc. Nat. t. xi. p. 150, Bot. 1859), partly on account of their embryos or propagative germs being locomotive—that is, polymorphic cells (minute *Amæbæ*), provided with one or two cilia, so that they can swim with the latter when in water, or creep

about by means of their polymorphic moto-plastic cell when on wet surfaces (under the form of *Amœbæ*). Now *Mucor*, *Achlya*, *Pythium*, and the Myxogastres all being allied to each other by this mode of propagation (that is, by minute amœbous or moto-plastic cells), we are not wanting in Fungi which produce embryonal forms that, if any of them chose to enter the human body, have the power, under the condition and circumstances above mentioned, to do so as easily through the sudorific ducts (or even directly, through the skin itself, for they have wonderful penetrating power) as an embryonal *Filaria*.

I would also add my opinion that the black fungus of the human body is a monster-form—from its sporangia, or large cells apparently identical with sporangia, never, to my knowledge, containing anything but an amorphous albuminous mass (abortive state of sporidia, which is chiefly the seat of the black colouring-matter, and ultimately becomes resinous or fatty?),—and thus that this fungus is no more capable of putting forth a true embryo which can propagate the species from one human body to another, or even out of the body, than the Guinea-worm; and that the natural habitat of the species is therefore, like that of the Guinea-worm, out of the body.*

It may, perhaps, be asked how I come to place *Mucor stolonifer* among the fungi which are propagated by polymorphic zoospores. My reply is, that I have met with a case in which

* I take from my "Note-book" the following short description of this fungus, which on a late occasion (28th September 1861) I examined half an hour after the amputation of the foot in which it was situated, with my namesake, who has the merit of having first pointed out its real nature in the Article to which I have above alluded, and to which I would direct attention for a more elaborate account of the disease, &c. :—

Foot.—Greatly enlarged, presenting several small cloacal orifices connected with branched sinuses originating around globular, black or dark-brown masses, ranging in size from microscopic minuteness to upwards of half an inch in diameter, situated in the bones and deep soft parts of the foot and ankle.

Black masses.—Globular, presenting a cauliflower surface, and breaking up with a like structure radiating from the centre; composed of short, irregular filaments of concatenated unequal-sized cells, bearing on their sides and ends larger ones (abortive spores?), which at first are pear-shaped, but afterwards become globular, filled with a homogeneous (albuminous?) substance coloured brown, which, swelling out the cell, appears to burst it, and, thus becoming free, affords the principal part of the colouring-matter and substance of the mass.

Iodine gives a deep claret-colour to the contents of the large cells (spores?), indicative of their amylaceous nature, and a deep sherry- or amber-colour to the rest of the structure, among which I observed starch-grains that appeared to me to belong to the fungus.

The best portions for illustrating this structure are the smallest and least coloured, not those which come from the large dark masses, for they seldom present much beyond homogeneity and colour.

many of the heads of *M. stolonifer* were composed of a mass of minute polymorphic cells (*Amæbæ*), which, after having been placed in water on a slide, soon separated from their globular aggregation, and crept away from each other under moto-plastic forms, which forms, under other circumstances, I assume, would have respectively been surrounded by firm, sporidious capsules, and, on the latter bursting in development, would have come forth as propagative amœbous germs or embryos, like those which come from the sporidia of the Myxogastres, with which family Corda has already placed the Mucoridæ, though not probably from the circumstance just mentioned, but from their general resemblance (Corda, *Icones Fungorum*, p. 19; and *Mucor stolonifer* seu *Rhizopus nigricans*, p. 20, tab. xii. fig. 83)*.

XLVIII.—*Contributions to an Insect Fauna of the Amazon Valley.*

COLEOPTERA : LONGICORNES. By H. W. BATES, Esq.

[Continued from p. 405.]

Group *Anisocerinæ*.

Genus TRIGONOEPLUS, Thoms.

Thomson, *Class. des Céramb.* p. 339.

THIS genus is an aberrant form in the group *Anisocerinæ*, differing from most of the other genera in having the terminal joint of the antennæ, compared with the penultimate, of normal length, and the elytra obtusely truncated at the tip, instead of rounded. It resembles the genus *Chalastinus* so much in general form that I have thought it better to place it in this group. The third and three following joints of the antennæ are slender and slightly thickened at the tips; this indicates an affinity with the *Anisocerinæ*, where the thickening of the tips of the antennal joints is a very general character. The typical species of *Trigonoepplus* (*T. signatipennis*, Thoms., a native of South-east Brazil) has a deep semioval notch in the middle of the epistome—a singular peculiarity of

* Familiar examples of these fungi are given, that the reader may the more easily procure them for examination. Abundance of the Myxogastres may be found on the dead wood in the building-timber and fire-wood yards during the monsoon, among which is the *Æthalum* or creeping-fungus," which, under the microscope, by transmitted light, affords one of the most wonderful objects in the world. To obtain this, look among the chips and sawdust of the astringent woods during the "rains," and having found a yellow- or a brown-coloured slime, take a piece of it, about half the size of a pea, and place it in a watch-glass with a little water; afterwards put the glass in a shaded or dark place for a few hours, when the *Æthalum* will, if young and fresh, have passed into an arborescent form fit for observation.

structure, of which it is difficult to guess the purpose, especially as the labrum beneath it remains entire. The species of this genus which I found in the Amazon region has the epistome of the usual shape, the muzzle, in fact, being of exactly the same form as in the next genus, *Chalastinus*. It differs also from the type of the genus in the shape of the head, the antenniferous tubercles not being at all salient, whilst they are strongly raised in *T. signatipennis*. It agrees, however, so closely with the typical species in all other characters that I think it cannot be separated from it generically. It will be convenient, nevertheless, to treat it as a group or subgenus, which may be named *Anepsius*.

Trigonoepplus (Anepsius) bispecularis, White.

Trigonoepplus bispecularis, White, Cat. Long. Col. in Brit. Mus. ii. p. 403, pl. 10. f. 1.

Found occasionally on foliage in the forest at Ega.

Genus CHALASTINUS, nov. gen.

Head narrow; antenniferous tubercles prominent. Antennæ slender, elongated, 11-jointed in both sexes, the terminal joint shorter than the preceding, filiform; the third and five following joints thickened at the tips and curved, especially in the ♂. Thorax much narrowed anteriorly, scarcely perceptibly tuberculated on the sides. Elytra subtrigonal, depressed, rounded together at the tips. Mesosternum bituberculated, hind margin sinking behind into a fovea in common with the fore edge of the metasternum. The fore tarsi of the ♂ not dilated, but fringed with fine hairs.

This genus has a great resemblance in general figure to *Thryallis* (Thomson, Class. p. 31); but the antennæ in *Thryallis* have only ten joints, and the sterna are broad and plane, the prosternum especially being remarkably broad. The Anisocerinae vary to such a degree in these and other parts of structure, that almost every species might be made into a separate genus, if we attached the same importance to those characters in this as in other groups of Coleoptera.

Ch. Egaensis, White.

Anisocerus Egaensis, White, Cat. Long. Col. in Brit. Mus. ii. p. 408.

The typical form of this species seems to be confined to the neighbourhood of Ega, on the Upper Amazons. It has on each elytron behind the middle a short, oblique, ochreous belt, commencing on the sides near the middle, and not reaching the suture, near which, in a line with the belt, is a round ochreous spot. This is common at Ega on decaying branches of trees in

the forest. The following slight local modification was found only at Fonte Boa, 120 miles in a straight line north-west of Ega.

Local var. *Ch. postilenatus*. Like the type, except that the oblique ochreous belt of the elytra is continuous from the sides to the suture, and is also prolonged as a stripe along the sides to the shoulders.

This variety wholly replaces the Ega form at Fonte Boa. At Cayenne a nearly allied undescribed form* occurs, which, although apparently very different from *Ch. Egaensis*, I believe to be a local modification of it. A species which varies in a small degree from locality to locality a short distance apart becomes modified in a greater degree in a more remote district and under more greatly changed local conditions; at least, the distribution of closely allied species and varieties, when carefully studied, seems to point to this conclusion.

Genus PHACELLOCERA.

Castelnau, Anim. Artic. ii. p. 468.

Char. emend. : Antennæ long and slender, eleventh joint about as long as the tenth, and filiform in both sexes; first joint slender at the base, and enlarged about the middle into a thick pyriform club; third joint thickened at the tip; fourth also sometimes dilated at its apex, and furnished with a small brush of hairs. Body elongate, parallel-sided, depressed. Thorax narrow, the lateral tubercles small, acute. The mesosternum plane or bituberculated, its hind margin depressed in conjunction with the fore edge of the metasternum, as is the rule in the Anisocerinae. The fore tarsi in the ♂ are not dilated, and scarcely fringed.

I think the following species may be comprised in this genus:—

1. *P. plumicornis*, Klug, Entom. Bras., specimen alterum, pl. 42. f. 5. South-east Brazil.

2. *P. Buquetii*, Guér. Icon. R. A. p. 240. Cayenne.

3. *P. Batesii*, Pascoe, Trans. Ent. Soc. Lond. 1858, n. s. iv. Upper Amazons.

4. *P. limosa*, n. sp.† Venezuela.

* This is extremely rare in collections; and I regret being unable, from having no specimen at command, to give a description of it.

† *P. limosa*. Corpus parum elongatum, depressum, fuliginosum, pilis minutis squamiformibus cinereo-fuscis vestitum. Antennæ (♀) corpore vix longiores, articulo quarto simplici. Caput et thorax punctata, hujus tuberculis lateralibus brevibus acutis, dorso trituberculato. Elytra passim granulato-punctata, singulis prope basin tuberculo magno cristato, et postice fasciulis duobus pilorum munitis. Antennæ fuscae, articulo tertio apice valde dilatato. Long. 6 lin. ♀. Hab. Venezuela.

Phacellocera Batesii, Pascoe.

Phacellocera Batesii, Pascoe, Trans. Ent. Soc. Lond. 1858, n. s. iv.

This species much resembles *P. Buquetii* of Cayenne, but it is considerably smaller. Its colour is light-greenish grey dusted with black; the sides of the head and thorax have a broad dusky stripe, and a narrow dusky zigzag belt runs across the elytra behind the middle, but does not reach the suture. The antennæ are three times the length of the body in the ♂, and not much shorter in the ♀; the joints are slender, almost capiliform, the basal one forms a very large and thick club, the third is thickened at the tip, the fourth simple like the rest; the apical joints are the longest: the colour is black, except a broad grey ring round the third joint.

This very curious insect is found at Ega, on the trunks and larger branches of fallen trees in the virgin forest. In crawling over the bark, it holds its antennæ straight forwards, and has a most striking resemblance to a greenish-coloured species of *Ptychoderes* belonging to the family Curculionides, which swarms at times on the same trees. I have a specimen from Yurimaguas, on the Huallaga, near the Andes, which differs (as all the other examples do which I have seen from the same place) from the Ega type only in being of a dull-grey colour without any greenish or olivaceous tinge.

Genus *ANISOCERUS*, Serv.

Serville, Ann. Soc. Ent. Fr. iv. p. 79.

This genus was founded by Serville on the *Lamia scopifera* of Germar, apparently the only species known at that time. Since then, a number of species have been added which do not belong to the genus, or at least would render its definition almost impossible were they to be included. I think it better to restrict it to those species which present the following characters:—

Body oblong, compact, subdepressed. Head broad; antenniferous tubercles slightly raised. Antennæ 11-jointed in the ♂, the terminal joint about half the length of the penultimate; 10-jointed in the ♀; the third joint in both sexes furnished at the tip with a compact rounded brush of short silky hairs. The mesosternum is very short, deeply depressed in the middle and on the hind edge in conjunction with the fore margin of the metasternum. The ligula is narrow at the base, then abruptly dilated, the lobes widely divergent. The palpi are gradually and obtusely pointed.

Anisocerus Onca, White.

Anisocerus Onca, White, Cat. Long. Col. Brit. Mus. ii. p. 405, pl. 10. f. 4.

Local var. *a. A. Fonteboensis*. Head and thorax as in *A. Onca*.

Elytra at the base reddish brown and granulated, each with two rounded spots, and the humeral callus black; the rest of the surface has four rows of quadrate black spots divided only by narrow lines of a reddish-brown colour, and before the apex is a transverse black streak; the spaces between these black spots are quadrate in shape, and of a pale ochreous hue. Abdomen beneath varied with black. This variety diverges from the type only in the increased size and squared shape of the black spots, and the pallid hue of the equally squared interspaces. It is intermediate both in character and in geographical position between the type and local var. *b*, and is found near Fonte Boa, on the Upper Amazons.

Local var. *b*. *A. Olivencius*. Much larger than the type, being 7-7½ lines in length. The occiput is black, with two pale ochreous lunate spots behind the eyes. Elytra at the base dingy ochreous and granulated, each with two rounded spots, and the humeral callus black; the rest of the surface is dark violet-brown, with four rows of angular spots, and the tip pale ochreous; the black spots in the same positions as in the type appear faintly through the violet-brown ground-colour. The rest as in the type. In this variety the pale spots of the elytra, already indicated in var. *a*, are strongly marked, and the ground-colour has become obscure. This change in the dress, added to the markings of the head and the size and robustness of the whole body, give the variety an aspect totally different from the typical form. Taken sparingly at St. Paulo de Olivencia: all the individuals found were conformable to the description here given.

This pretty insect seems very susceptible of local modification. The typical form is confined in its range to a very limited area around the town of Ega, on the Upper Amazons. It is there found in plenty on the trunks and branches of fallen trees in the virgin forest. At Fonte Boa, 120 miles above Ega, it occurs under a slightly modified local form (*A. Fonteboensis*), which would be scarcely worthy of remark were it not intermediate between the Ega type and the strangely transformed local variety or race, *A. Olivencius*, found at St. Paulo, 180 miles further west, or 300 miles in a straight line over a uniform country undivided by physical barriers from the home of its type. As before remarked, when a species varies in this way from district to district not far apart, it often happens that several closely allied but more distinct forms or species present themselves in districts further removed; these may be fairly suspected of being also modifications, considering the proof already obtained of the variability of the species. Several of these nearly allied forms occur in the present case. Thus I have no doubt, on perusing the excellent description, that the *A. stellatus* of Guérin-Méne-

ville (Cat. Ins. Coléop. recueillis par Oseulati, p. 27), found in Ecuador, probably on the banks of the Napo, is a further modification of the *A. Onca*, in the direction of our var. *Olivencius*. There is also an undescribed species found at Cayenne (*A. multiguttatus*, Laferté, MS.)*, which diverges from *A. Onca* in another direction; and this may with great probability be referred to the same type. It is the custom of naturalists, when they subordinate varieties to a species, to fix upon one of the forms as the original, to which the rest are referred: this original is generally the one first described or best known. In accordance with this usage, I have said that such and such forms are varieties of *A. Onca*; but, strictly speaking, no form can be said to be a variety of *another existing* form unless it can be proved or shown to be highly probable that the one *descended* from the other, this other itself remaining meanwhile unchanged. It is necessary, therefore, to guard against the error of supposing that the arbitrarily chosen forms we see placed as species, with varieties subordinated to them are the true parents of those varieties; for whilst the varieties were being formed the parents themselves may have been undergoing modification, and therefore the so-called species and their varieties may be all equally varieties of some common possibly extinct form. In the present case, all that I mean to convey is, that, reasoning upon the fact of much local modification in *A. Onca*, we are constrained to infer that other closely allied forms have been derived from a pre-existing one nearly resembling them; and this might have been either *A. Onca* or the common parent of *A. Onca* and its subordinates†.

* I regret being unable, not having a specimen at command, to give a description of this species.

† Some entomologists, however, believe that a local variety is an original creation equally with a species. Dr. Schaum, an author of high reputation, says, in discussing a case of local variation similar to the present one (Berliner entom. Zeitschr. 1861, p. 398), that many pairs of a species were originally created, and that, as there would be original differences amongst the individuals according to locality, so we have, at present, local varieties. This view will recommend itself to some minds by its extreme simplicity; for the excessive complexity of the relationships between existing varieties and species, on the other view above stated, repels by its difficulty of unravelment. In no case does the remark of Bacon so well apply, to the effect that the subtlety of nature far exceeds the subtlety of man's intellect. But Dr. Schaum's view ignores the fact that many local varieties shade off into mere individual variations or differences, such as we see occurring amongst the offspring of the same parents, making it extremely probable that local varieties or races have been derived by ordinary generation, with modification, from pre-existing forms. The hypothesis of the persistence, under the same conditions, of a local variety from the time of its creation is also quite at variance with the great mass of evidence, supplied by geology, of great migration and dislocation of species during the glacial and other epochs.

Genus GYMNO CERUS, Serv.

Serville, Ann. Soc. Ent. Fr. 1835, p. 84.

In this genus both sexes have eleven joints to the antennæ. According to Serville, the ♂ has the terminal joint very long. Amongst the species which I propose to include in the genus, some have this joint as long as the tenth, others much shorter; and it is always relatively shorter in the ♀ than in the ♂. All the joints are naked; but the third in some species, and the fourth in others, are more or less thickened at the tip. The body is convex and rather broad, and the elytra somewhat more gradually rounded to the apex than in *Anisocerus*.

This genus was omitted in Mr. White's 'Catalogue of the Longicorn Coleoptera of the British Museum;' and some of the species were included by him under *Anisocerus*, from which they are distinguishable by the naked antennæ.

1. *Gymnocerus capucinus*, White.

Anisocerus capucinus, White, Ann. Nat. Hist. xviii. t. 1. f. 7; Cat. Long. Col. Brit. Mus. ii. p. 406.

This remarkably beautiful species, which in its colours and markings resembles some kinds of *Doryphora* of the Chrysomelidæ group, I found only at Caripí, near Pará. It occurred sparingly, in January, on dead branches of trees in the forest. The third antennal joint is considerably thickened at the apex.

2. *Gymnocerus dulcissimus*, White.

Anisocerus dulcissimus, White, Cat. Long. Col. Brit. Mus. ii. p. 406.

I met with this species only on one occasion, in the forests on the banks of the Cuparí, a branch of the Tapajos, in 4° S. lat. and 55 W. long. It is still more beautiful in colours than *G. capucinus*; but I believe, with Mr. White, that it may be only a modification of that species. The third antennal joint is less thickened at its apex than in *G. capucinus*.

Three individuals only occurred, on a decaying branch in the depths of the forest.

3. *Gymnocerus cratosomoides*, n. sp.

G. ovalis, convexus, tomentosus, ochraceo-fulvus: thorace lævi: elytris seriatim punctato-granulatis, singulis prope basin tuberculo magno glabro instructis et apud medium breviter quadricarinatis, fascia lata undulata pone medium et marginibus posticis fuscis. Long. $9\frac{1}{2}$ lin. ♀.

Head dull-greenish yellow, tomentose, smooth. Antennæ slender, shining black, about the length of the body, the third joint scarcely thickened at the apex. Thorax about half the breadth of the elytra; lateral tubercles rather small, acute, the surface

quite impunctate; the disk tawny brown; the sides yellowish. Elytra very broad at the base, the breadth at that point being three-fourths the length; they are very gradually narrowed to two-thirds the length, thence more rapidly narrowed to the apex; each has in the middle, near the base, a very large naked obtuse tubercle; behind this, on the disk, are four short raised longitudinal lines, the one nearest the suture only being strongly elevated; the basal two-thirds of the surface is scantily covered with granulated punctures, mostly arranged in lines, each of which is accompanied by a dark-brown speck; the colour is ochreous brown or tawny; the posterior part of the suture and the discal ridges are finely streaked with grey; behind the middle is a broad irregular dark-brown belt, preceded by a yellow line; the dark-brown colour runs from the belt along the margins and suture to the apex. The body beneath and legs are clothed with greenish-yellow pile, which is denser on the sides of the breast and on the tarsi. The fore tibiæ are dilated and compressed.

One example, taken on the trunk of a tree at Tunantins, on the Upper Amazons. This and the following have a most deceptive resemblance to species of Curculionidæ of the genus *Cratosomus*, which occur in numbers on the trunks of certain trees. The general colour is exactly the same, and the resemblance is made more perfect by the large, glossy, basal tubercles of the elytra, which are merely modifications of the ordinary centro-basal ridges existing in this section of the Lamiaires. The shortness and slenderness of the antennæ, rendering the organs almost invisible at a short distance, also assist in perfecting the disguise, which completely deceived me when I saw the insect *in situ*. *G. scabripennis* (Serville), a native of Cayenne, belongs to this same group, all the forms of which appear to be excessively rare.

4. *Gymnocerus crassus*, n. sp.

G. ovalis, convexus, tomentosus; thorace elytrisque fulvis, his fascia latissima et macula subapicali canis. Long. $8\frac{1}{2}$ lin. ♀.

This species very much resembles the preceding, and might be treated as a variety of it, although it seems more convenient to deal with it as a separate form. The punctures of the elytra, with their granulations, are much more strongly developed; otherwise the only differences observable are those of colour. The head is greenish yellow, with the crown and occiput grey. The thorax does not differ from that of *G. cratosomoides*. The base of the elytra is occupied by a narrow belt of a fulvous colour, and a much broader belt of the same hue crosses the elytra behind the middle; the rest of the surface is hoary grey, with

the exception of the margins and suture near the apex, which are blackish.

I found one individual only of this form at Ega, on the trunk of a tree.

5. *Gymnocerus monachinus*, White.

Anisocerus monachinus, White, Cat. Long. Col. in Brit. Mus. ii. p. 406, pl. 10. f. 3.

This magnificent species varies in size from $7\frac{1}{2}$ to 11 lines. The fourth antennal joint is gradually and slightly dilated at the apex, the third is simple. The ground-colour of the upper surface in the ♂ is chalky white, in the ♀ rose-red, the latter being very bright during life. I found the species only within a radius of twenty miles of Ega, on the Upper Amazons. At Nauta, 540 miles to the west of Ega, the species recurs in a modified state; the modification is one of colour only, but is remarkable for its distinctness and its occurring in both sexes. The following is a short description of it:—

Local var. A. *Nautensis*; 8 lines, ♂ ♀.

The white fascia of the elytra is very much broader; the second black belt extends posteriorly along the suture, and the tooth-shaped black streak near the apex is replaced by a distinct isolated round spot.

I received one pair of this variety from Nauta, on the banks of the Upper Amazons, in Peru.

Genus *ONYCHOCERUS*, Serv.

Serville, Ann. Soc. Ent. Fr. iv. 83.

In this genus the antennæ have eleven joints in both sexes, but the terminal joint is much thinner than the others, and claw-shaped. In the males several of the apical joints are fringed beneath with long hairs; the second joint in both sexes is remarkably elongated. The sterna are in some species simple, and in others tuberculated, showing that this character has no generic value; for this genus is one of the most natural of the whole tribe. The tarsi of all the legs are strongly dilated; the fore tarsi of the males are more widely broadened than the others, but they are not fringed with long hairs. The ligula is elongated, not dilated on the sides, but simply rounded; the two lobes approximate, but are not united on their inner edges.

1. *Onychocerus scorpio*, Fabricius.

Lamia scorpio, Fabr. Mant. Ins. i. 131. 8.

—, Fabr. Ent. Syst. i. ii. 273. 26.

This well-known and common species is always found on the trunk of a particular kind of wild fruit tree called by the natives

of the Amazon region Tapiribá; and the strange sculpture, shape, and colours of the body and limbs of the insect give it a most wonderfully exact resemblance to the bark. It is not possible to distinguish the insect, although a very large one (sometimes an inch long and a third of an inch broad), unless the tree is carefully examined. The tree is planted in fences very commonly in and near towns, on account of its rapid growth, and the insect accompanies it everywhere with the pertinacity of a parasite. It sometimes swarms on felled logs of Tapiribá.

2. *Onychocerus concentricus*, n. sp.

O. ovalis, postice paulo dilatatus, cinereo-fuscus: elytris multituberculatis, violaceo tinctis, lineis pallidioribus curvatis quasi concentricis ornatis. Long. 7 lin. ♂ ♀.

Head and antennæ dull black. Thorax ashy brown, the sides below the lateral tubercles black; the disk punctured and trituberculate. Elytra widest behind; the sides near the base thickly granulate-punctate; the upper surface furnished with about four rather distinct rows of large and small acute dusky tubercles; ashy brown, the disk tinged with purplish, with several rather indistinct curved belts alternately of a darker or paler hue; the first is dark, and near the base on the outer side of the centro-basal ridge; the second, pale, is exterior to the first, and strongly curved outwards; the third, more distinct, of a dark colour and strongly curved, touches the suture, and forms a semicircular belt common to both elytra. The body beneath and legs are black, and clothed with ashy-brown pile. The three terminal joints of the antennæ in the ♂ have a few hairs beneath. The pro- and mesosterna are simple, the latter sloping from the hind to the fore margin.

I found this species on one occasion only, in great plenty, on a felled tree at Carípi, near Pará. The colour and sculpture of the insect gave it a deceptive resemblance to the bark on which it adhered.

Genus XYLOTRIBUS, Serv.

Serville, Ann. Soc. Ent. Fr. iv. 80.

The antennæ are short and mis-shapen; the third and fourth joints are dilated on one side at the tip, the fourth much more broadly so than the third. The eleventh joint is long and slender in the ♂, short and subuliform in the ♀. The head is narrow on the vertex, broadening below to the end of the muzzle, which is elongated. The terminal joint of the palpi is obtusely truncated at the tip. The ligula is short, slightly dilated in the middle, and the lobes joined together along their whole length, the two being conjointly and obtusely rounded at the apex.

The prosternum is simple, the mesosternum short and bituberculated. The body is oblong and somewhat depressed. The thorax is short, transverse, and the lateral tubercles are small. The fore tarsi of the males are simple, and have only a slightly denser fringe of hairs than those of the females.

This genus is very closely allied to *Acanthotritus*, White (Cat. Long. Col. Brit. Mus.), and I think the latter might be with great advantage united to it. It appears to have been overlooked by Mr. White.

Xylotribus simulans, n. sp.

X. castaneo-rufus, thorace flavo trilineato: elytris pone basin minute granulatis et flavo sparsim irroratis, fascia lata sericeo-brunnea pone medium et prope apicem maculis oblongis carneis ornatis. Long. $5\frac{1}{2}$ lin. ♂ ♀.

Head dull red; front with four longitudinal yellow lines, the two outermost running obliquely down the muzzle from beneath the eyes. Antennæ about the length of the body, shining dull red. Thorax with two short transverse raised lines on the disk, dull reddish, with three fine, interrupted, dorsal, yellow lines. Elytra with the basal half minutely, densely, and evenly granulated; the colour of the surface is reddish brown, the basal half sprinkled with small yellow specks of different sizes and shapes; close behind the middle is a rather broad, silky, brown fascia, not touching the suture, its fore margin dentate and speckled with yellow; behind the fascia are a few oblong flesh-coloured spots, which are placed longitudinally at first, and then towards the apex transversely.

The body beneath and legs are dull reddish; the fore coxæ and a few spots on the sides of the breast are yellow, and there is a large, round, bright orange-yellow spot on each side of the post-pectus; the abdomen has on each side two rows of round whitish spots.

I have adopted for this species the name under which it stands in White's Catalogue; but it has not before been described. It seems to be peculiar, like nearly the whole of the *Anisocerinae* I have here enumerated, to the Amazon region. I found it on the Lower Amazons only, at Obydos, Santarem, and Pará. It occurs on woody sipós or lianas, especially those which have been severed with knives or axes, on the borders of new clearings. It is closely allied to the *X. heterocerus* of Serville, to which in fact it should stand in the relation of a geographical form or race.

Genus HOPLISTOCERUS, Blanch.

Blanchard, Voyage de D'Orbigny, Ins. p. 210 (not characterized).

The antennæ in this remarkable genus are short and thick as

in *Xylotribus*, and the eleventh joint in the ♀ is slender and claw-shaped. The basal joint is thickened from the base; the second, third and fourth are each produced at their tips into a very sharp and rather long spine. The body is oblong and depressed; the thorax cylindrical and unarmed. The species are adorned with brilliantly metallic colours. The terminal joints of the palpi are gradually and sharply pointed.

Hoplistocerus gloriosus, n. sp.

H. castaneo-rufus, glaberrimus, antennis pedibusque violaceo-cupreis: elytris alutaceis, confertim punctulatis, rubro-cupreis, vitta angusta suturali apicem haud attingente, altera lata marginali viridi-cyaneis. Long. 5 lin. ♀?

Head and front tumid, very finely rugose-punctate; occiput and thorax marked with fine transverse striæ. The cheeks have a spot of brilliant green; the rest of the head and thorax is of a dark-chestnut hue. The elytra are oblong, broadly rounded behind, even on their surface, and uniformly punctured; their colour is red or orange-copper, with the exception of a narrow sutural stripe not extending to the apex, and a broader marginal one, which are of a greenish-blue lustre. The antennæ and legs are of a brilliant violet copper hue; the underside of the body is chestnut-red, and, with the legs and the other portions of the body, glabrous.

I took one individual only of this extraordinary and beautiful Longicorn, flying over a mass of dried twigs in an open place in the forest at Ega. It has a near resemblance to the *Hoplistocerus refulgens* of Blanchard (Voy. de D'Orbigny, Ins. p. 210, pl. 22. f. 9); but that species is described as having the body, with head and thorax, of a green colour. D'Orbigny's species was taken in the province of Santa Cruz de la Sierra (Bolivia), which region is connected with the Ega district by an uninterrupted stretch of low wooded country over 14° of latitude. I have seen several undescribed and distinct species of this genus in the collections of Count Mnischez at Paris and Messrs. Bowring and Pascoe in London.

Genus CYCLOPEPLUS, Thomson.

Thomson, Classif. des Cérambyc. p. 32.

In this genus, which is still more extraordinary in form than the preceding, the second and third antennal joints have an elongated and very slender spine at their tips; but the fourth, instead of being armed with a spine, is dilated on one side of the apex into a large, thick, rounded knob, clothed with a velvety pile. The antennæ differ also from those of the preceding two genera in being greatly elongated and slender, in the ♂

being twice the length of the body. The basal joint is very thin at its origin, and is dilated beyond the middle into a pyriform club; in length it departs from the almost universal rule in the subtribe Acanthoderitæ by being as long as the third. The fore tarsi in the ♂ are strongly dilated and fringed.

Cyclopeplus Batesii, Thomson.

Cyclopeplus Batesii, Thoms. Class. de Céramb. p. 32.

Ega, Upper Amazons, on dead branches on the margins of small tobacco plantations in the forest. The form of the insect is quite an exception to the prevailing character of the Longicorn family, the elytra being excessively dilated—in fact, as near as possible hemispherical in shape, instead of elongated as is the almost universal rule. When I first met with it, I was deceived by its great resemblance to a common insect of the family Eumorphidæ (*Corynomalus discoideus*) which swarms at times on the same decaying branches of trees on which the Longicorn is found. It is true the size is much larger than that of the *Corynomalus*, but this is not noticed when they are *in situ*. The very curious black knob on the fourth antennal joint assists greatly to complete the disguise; for this mimics the terminal club of the antennæ of the *Corynomalus*; and as the remaining joints in the Longicorn are very slender and imperceptible when the insect is on the tree, the organs in motion resemble precisely those of the *Corynomalus*. It is further remarkable that the Longicorn mimics especially a pale variety of *Corynomalus discoideus*, which is the prevailing form of the species at Ega.

A second species of this genus is known from Cayenne,—the *Cyclopeplus cyaneus* (Thoms. *l. c.*). I do not know whether this has its analogue in the same country, in a species of *Corynomalus*. Both species are excessively rare. The Anisocerinæ furnish many instances of adaptive mimetic resemblances; and to this peculiarity of the group is no doubt attributable the strange divergences or aberrations of form which it contains. In addition to the clearer cases which I have noticed, there are others not quite so evident. For instance, I think our *Hoplistocerus* is the mimetic analogue of a species of *Stenochia*, a Heteromerous genus, and the *Acanthotritus dorsalis* of South-east Brazil appears to resemble much a species of *Heilipus*, belonging to the family Curculionidæ. The *Onychoceri*, instead of mimicking other insects, have deceptive resemblances to the bark of trees on which they live. A tendency to mimetic resemblances seems to run in certain groups; and these groups are remarkable for the aberrations from their types in minor points of structure or in facies, and for the rarity and diversity of the specific forms which they contain.

[To be continued.]

XLIX.—*Supplement to a Memoir on the Thalassinæ**.

By Dr. STRAHL†.

AMONGST the reasons cited by De Haan ('Fauna Japonica,' p. 160) in favour of the union of the *Astacoidea* and the *Thalassinioidea*, the relation of the simple branchia to the fifth pair of feet plays a not unimportant part. He states that although the *Astacoidea* possess this single branchia, which is wanting in all *Thalassinioidea*, the genus *Astacus* itself belongs by its species to both sections, and effects the union. Subsequently, however, Erichson divided the genus *Astacus*, employing for this purpose especially the characters of the branchiæ; so that, by this division into new genera, the separation of the *Astacoidea* and *Thalassinioidea* might appear to be again established. The genera *Cambarus* and *Cheraps*, which are destitute of the branchia on the fifth pair of feet, and were therefore removed from the genus *Astacus*, nevertheless approach more closely to *Astacus* and its allies than to the *Thalassinioidea*. *Cheraps* even gives up another character of the *Astacoidea*, namely, the appendages on the first segment of the abdomen in the male sex, which are likewise wanting in the genera *Astacoides* and *Engæus*, and makes another step towards the *Thalassinioidea*; nevertheless its relationship to *Astacus* and its allies is greater than to the *Thalassinioidea*. The common characters of the genera grouping themselves immediately about *Astacus*, besides the perfectly developed antennal scale (*armiger* and *squama*), are, that the first three pairs of feet are didactyle, and the external lamina of the caudal fin transversely divided; the forehead bears a rostrum projecting over the eyes, beneath which the latter are concealed whenever the appearance of danger causes them to require protection. Here belong the genera, *Homarus*, *Nephrops*, *Paranephrops*, *Astacus*, *Astacoides*, *Engæus*, *Cambarus*, and *Cheraps*. I propose to group these together as *Astacina*.

Glaucothoë and *Axius* are not to be placed here, although they are stated to possess the antennal scale; at any rate, they have fewer didactyle feet, and the outer lamina of the caudal fin is entire. In describing *Axius plectrorhynchus*, I have pointed out the difficulty which existed in determining whether this species does or does not possess a moveable scale. It now appears to me doubtful whether *Axius* and *Glaucothoë* have a moveable scale, because the existence of this belongs to the general character of the *Astacina*, from which both these genera depart in several respects; and, indeed, they cannot even be referred to a common

* See 'Annals,' May 1862, p. 383.

† Translated by W. S. Dallas, F.L.S., from the 'Monatsber. der Akad. der Wiss. zu Berlin,' February 1862, p. 133.

group, but must decidedly be separated, as I will immediately show. Hitherto I have been unable to examine *Axius sthynchus* and *Glaucothoë Peronii* in connexion with the existence or absence of the moveable scale. Should it prove that these species possess only the armiger, *Axius* and *Calocaris* would probably have to be united; for the latter has certainly no scale (see the figure in Bell's 'British Crustacea,' p. 233), and the other differences are not sufficient to support the division into two separate genera.

That *Gebia* possesses no antennal scale is perfectly correct, although Dana thinks that his *G. pugettensis* might possess a scale. In *G. barbata*, described by me as new, the same structure, however, occurs; and I have pointed out that, great as the illusion may be, there is nothing but a fringe on the second joint, which, moreover, also occurs in *G. littoralis*. I have even seen a specimen of *G. barbata*, of which the left external antenna exhibited the fringe uninjured, while on the right side the hairs of the fringe were rubbed off, so that no one could be misled into the assumption of a scale. In the same way probably the fringe of *G. hirtifrons*, White, as figured by Dana, has been destroyed, and the fringe belongs to the general generic character. Consequently *Gebia* is throughout destitute of all trace of a scale, and *G. hirtifrons* does not constitute the type of a series of *Gebia* unfurnished with fringes.

The new genus *Trypæa* is represented by Dana as allied to *Callianassa*. The structure of the external maxillipeds and of the five pairs of feet, and the configuration of the abdomen, especially in regard to the appendages, certainly agree in the two genera; but the eye-peduncles are different. In *Trypæa*, according to Dana's own drawing, these are cylindrical with a terminal cornea; but he expresses an opinion that they may be incorrect, as he could not make another comparison with nature. However, a further distinction is furnished by the structure of the outer antenna: as far as we can judge from Dana's figure, this has neither squama nor armiger. Consequently the gap between *Callianassa* and *Trypæa* would be greater than is stated by Dana. A second species, *T. porcellana*, has been described by Kinahan ('Journ. Roy. Soc. Dubl.' i. p. 130, pl. 4. fig. 2), but this is probably only a *Callianassa*; for, to judge from the figure, the flagella of the inner antennæ are rather long, and certainly longer than their third joint, which is in opposition to Dana's diagnosis; moreover he says of the eyes that they are sessile, but from the figure it is clear that they present the peculiar structure of *Callianassa*. The character of the external antennæ cannot be determined with certainty from the figure.

It is true that all *Thalassinoidea* have no branchiæ on the fifth

pair of feet, and that the outer lamina of the caudal fin is entire; nevertheless, even here two perfectly different forms occur, for which the characteristic, distinguishing points of organization have yet to be ascertained. In many the first two pairs of feet are cheliferous, namely, *Axius*, *Calocaris*, *Callianassa*, *Trypæa*, *Scytoleptus*, *Callianidea*, and *Callisea*; the others, *Glaucothoë*, *Calliadne*, *Laomedia*, *Gebia*, and *Thalassina*, have only the first pair of feet cheliferous, and these in the last two genera are even subcheliform. Taking into consideration the character of the outer antenna, *Calocaris*, *Callianassa*, and *Thalassina* may be united, as possessing only the armiger; *Axius* and *Glaucothoë* also probably belong here. There then remain *Scytoleptus*, *Laomedia*, *Calliadne*, *Trypæa*, *Gebia*, *Callianidea*, and *Callisea*, which possess neither squama nor armiger.

Neither the characters of the cheliferous feet nor those of the external antennæ, however, unite the genera most nearly allied in their external conformation; but the relation of the pedunculated eyes to the forehead and its process furnishes a more accordant division. In *Axius*, *Calocaris*, *Gebia*, *Scytoleptus*, *Laomedia*, and *Calliadne*, the forehead projects beyond the eyes; and the latter can be concealed under it, as in the *Astacina*. We name this group *Gebiina*. The others, namely, *Glaucothoë*, *Callianassa*, *Thalassina*, *Trypæa*, *Callianidea*, and *Callisea*, have no such projecting forehead, and their eyes lie free in front of it. This latter group we may name *Thalassinina*.

The *Astacida*, consequently, split up into *Astacina*, *Gebiina*, and *Thalassinina*.

L.—On some new Coleoptera from Lizard Island, North-eastern Australia. By FRANCIS P. PASCOE, F.L.S. &c.

LIZARD ISLAND is one of the group forming the Great Barrier Reef on the north-east coast of Australia, in (about) 14° S. lat., 145° E. long.; but it is so small that its name is only to be found on the larger maps. Calculating in a rough way, it may be about 200 miles south and a little east of Cape York, the northern extremity of the continent.

The collection which is the subject of this paper was formed by Mr. Macgillivray, and is a small one, so far as the number of species is concerned; but if, as is probable, it was obtained during the casual stay of his ship for water or wood (perhaps only a few hours), the 700 specimens (mostly Coleoptera) which it contains indicate a greater amount of insect life than could have been anticipated. Of course a collection so formed cannot justify us in drawing any very definite conclusions; but it is

because of its proximity to Torres Strait, which divides the Neso-Indian from the Australian province—so far, at least, as the Coleoptera are concerned—that we welcome anything which may add to our scanty knowledge of the productions of its two shores.

Contrary to what might have been expected, there was almost a complete absence of Neso-Indian forms: a *Lomaptera* and a *Chariotheca*, which has now for the first time to be added to the Australian list, were, I believe, the only ones. On the other hand, there was a total, or nearly total, absence of the commonest Australian genera, e. g., *Castiarina*, *Temognatha*, *Lamprima*, *Anoplognathus* and the *Lamellicornia* generally, *Belus*, *Phoracantha* (one specimen), *Saragus*, *Amycterus*, &c.,—thus showing a tendency towards the Neso-Indian province, where those genera are unknown; or, as in the case of *Phoracantha*, only represented by a single species.

So far as our knowledge at present extends, everything points to the conclusion that the peculiar forms of the Australian fauna have their maximum in the temperate portion of the continent, and that there is evidence of their dying out or becoming less abundant as they approach the north. What is the proportion of the Neso-Indian forms which may be expected to occur in tropical Australia remains to be seen.

The species which I have selected for description are among the most interesting novelties of the collection.

Fam. Cicindelidæ.

Distipsidera Grutii.

D. nigro-chalybea; labro nigro, medio albo; elytris transversim rugulosis, purpureis, maculis quinque albis ornatis.

Dark chalybeate blue, shining; head concave in front, longitudinally striated near the eyes; lip black, with a broad longitudinal white stripe in the centre; antennæ brown; palpi black, second and third joints of the labial yellowish white; prothorax finely punctured, constricted anteriorly and posteriorly, bulging at the sides, canaliculate in the middle; elytra transversely plicato-punctate, the apex entire, two smooth yellowish-white spots at the base, behind these a sublunate patch, and a little behind the middle two more, one of which is marginal; body beneath dark chalybeate blue; legs black, with a few white setose hairs, the four anterior pair with the base of the femora and the two posterior trochanters yellow. Length 7–8 lines.

I have dedicated this elegant species to my friend Ferdinand Grut, Esq., whose devotion to the Geodephagous families of the Coleoptera is well known to entomologists.

Fam. Helopidæ.

Omolipus socius.

O. ater, nitidus; elytris seriato-punctatis, his prothoracis basi latioribus; antennis tarsisque concoloribus.

Deep glossy black; head and prothorax very minutely punctured; elytra rather broader than the prothorax at the base, each with about nine rows of deeply-impressed, rather distant punctures, those of the two nearest the suture smaller; antennæ and legs black, shining; tibiæ at the base and tarsi clothed with fulvous hairs. Length 5 lines.

Nearly allied to *Omolipus corvus*, Pasc. (Journ. of Entomol. i. p. 127), but with the prothorax broader and less contracted at the base, yet narrower than the base of the elytra, the humeral angles more obvious, and the punctures less deeply impressed, especially on the two sutural rows; the antennæ and tarsi are also destitute of the brownish hue of the former species.

Chariotheca amaroides.

C. latiuscula, atra; prothorace subquadrato, lateribus marginatis; elytris ovatis, cupreis.

Rather broad and robust for this genus, smooth, glossy black; head with a few coarse punctures between the eyes; lip nearly hidden; antennæ scarcely longer than the breadth of the head; prothorax very minutely punctured, transversely subquadrate, narrowly margined, the sides rounded anteriorly, but curving inwards towards the base; elytra ovate, seriato-punctate, copper-brown (but under the lens they are seen to be mottled with metallic green); legs and body beneath glossy black. Length 6 lines.

In its form this Helopian resembles some species of *Amara* or *Zabrus*; except that the upper lip is less exposed, I see nothing to distinguish it from *Chariotheca*.

Tragocerus formosus.

T. flavo-luteus, pilis brevibus suberectis vestitus; elytris fasciatis, singulatim tricarinatis, carina suturali abbreviata, apice sinuatis.

Luteous, covered with short, coarse, nearly erect hairs; head with a short impressed line between the eyes; antennæ about half the length of the body, covered with a fulvous pile; prothorax unarmed, slightly narrowed in front, curved inwards at the side near the base, the disk dark glossy brown, surrounded by coarse fulvous hairs; scutellum triangular, smooth, dark brown; elytra elongate, each with three prominent carinæ, the outer extending from the base to the apex, the second nearly as long, the inner one only about half the length, the apex sinuated,

not spined nor angulated, the base dark brown, a pale-yellowish band in the middle, preceded by a narrow and followed by a very broad dark-brown band, beyond this to the apex bright fulvous yellow; legs luteous, pubescent; body beneath dark shining brown, the propectus and margin of the abdominal segments hairy, fulvous. Length 12–13 lines.

A very distinct and handsome species, approaching most nearly in its coloration to *Tragocerus Spencei*, Hope.

Fam. Lamiidæ.

Symphyletes vetustus.

S. dense griseo pubescens, luteo alboque varius; prothorace tuberculato; elytris basi granulatis, apice subtruncatis, externe emarginatis, plaga laterali fasciaque dentata pone medium albidis.

Closely covered with a dark-greyish pile, varied with fulvous and white; head canaliculate in front; antennæ ciliated beneath; prothorax transverse, irregularly tuberculate; elytra much wider than the prothorax at the base, the shoulders produced, the sides gradually receding to the apex, which is nearly truncate, with the outer angle slightly emarginate, finely punctured, the base with a few black shining granules, a large patch at the side and an oblique irregular band behind the middle white, which also, like the rest of the elytra, are spotted with fulvous; legs brown, varied with fulvous; body beneath hairy, brownish grey. Length 12 lines.

Differs from *Symphyletes sodalis* in its denser pubescence, the fascia on the elytra nearer the middle, the patch at the side more band-like, and the apex subtruncate and slightly emarginate externally.

Niphona irata.

N. hirsuta, pube grisea fusco varia; elytris parce fortiterque punctatis, fascia obliqua pone medium suturam non attingente dilutiore.

Pitchy black, covered with a coarse greyish pile, beset with numerous short stiff pale hairs, and clouded with brown, the upper surface coarsely and remotely punctured; head not canaliculate in front; antennæ shorter than the body, all the joints, from the fifth inclusive, white at the base; prothorax nearly regular, with a short lateral tooth anteriorly; elytra rather short, broadest at the base, gradually narrowing posteriorly, the apex rounded, behind the middle an oblique whitish band not reaching the suture; legs greyish, more or less ringed with brown; body beneath dull grey, spotted with brown. Length 5 lines.

Near *N. insularis*, but narrower, much more strongly punctured, with a thicker and coarser pile, and without the fulvous tint of that species.

Zygocera luctuosa.

Z. albo pubescens, maculis fasciisque atris ornata; scutello postice et ad latera rotundato; elytris basi cristato-plumosis.

Black, closely covered with a somewhat ashy-white pile, banded and spotted with black; head white, with two black stripes in front and one beneath each eye, and two black spots on the vertex; antennæ black, the intermediate joints white at the base; prothorax transverse, the lateral spine behind the middle, the disk not tuberculate, white, with three black bands; scutellum white, rounded at the sides and behind; elytra subtrigonate, the shoulders produced, the base gibbous, bearing a narrow crest, which is crowned with short erect hairs, the posterior half with a single carina, which terminates in the apical spine, base black, except a white spot above the shoulder, the disk with a few black spots, in the centre of each of which is a round smooth puncture, posteriorly two black irregular bands; legs pubescent, white, banded with black; body beneath glossy black, with patches of white hairs, particularly on the sides of the abdominal segments and sterna. Length 5 lines.

A beautiful species, allied to *Zygocera plumifera*, but readily distinguished (*inter alia*) by its colour, form of scutellum and prothorax.

Meton tropicus.

M. nigro-piceus, parce grisescente pubescens; prothorace transversim subquadrato, ad latera granulato et spina minuta instructo; elytris postice albo fasciatis.

Pitchy black, rather sparsely covered with short greyish hairs; antennæ scarcely longer than the body, black, with all the joints, except the basal, covered with a greyish pile; prothorax transversely subquadrate, with a pale-greyish stripe in the middle, the sides darker, inclining to brown, and furnished with numerous black shining granules, lateral tooth small; scutellum transverse, pale grey; elytra broadest at the shoulder, gradually receding to the apex, tuberos or crested at the base, the crest together with the basal half of the elytra with several glossy black granules, the posterior half pale brown, with a transverse white band, a little bent near the suture, towards the apex; legs pubescent, greyish; body beneath pitchy, with a greyish pile. Length 6 lines.

This species is more nearly allied to the Aru *Meton granulicollis* than to the Australian *Meton Digglei*, agreeing with the former in the style of coloration, the granulated prothorax, with its small lateral tooth and the narrower elytra, but differing in the broader and shorter prothorax, more trigonate elytra, the nearly transverse posterior band, and more ashy hue. *Meton* has been re-

cently characterized in the 'Journal of Entomology,' i. p. 342; but the descriptions of the two species mentioned above will be found in the 'Transactions of the Entomological Society,' ser. 2. vol. v. pp. 42 & 59.

Mycerinus aridus.*

M. angustulus, rufo-testaceus, totus pube griseo-alba tectus; antennarum articulis tertiis quartisque equalibus.

Somewhat narrow, reddish brown, everywhere covered with a thin greyish-white pile; head slightly canaliculate in front; antennæ as long as the body, ciliated beneath, the third and fourth joints equal; prothorax scarcely longer than broad, narrower anteriorly, with a central raised line; scutellum transverse; elytra subparallel, slightly punctured at the base, rounded at each apex; legs sparsely pubescent; body beneath with the pile somewhat coarser. Length 6 lines.

Very like the Senegal *Mycerinus dorcadioides*, but narrower and unicolorous, although the elytra show faint traces of two stripes, caused, however, by a greater thinness of pubescence.

From Aneiteum, one of the New Hebrides, Mr. Macgillivray has also sent a remarkable form, belonging to the family Anthribidæ, which I have described below under the name of *Bythoprotus lineatus*. But for its antennæ and long fore legs, it might be taken at the first glance for a specimen of the *Macrodactylus flavolineatus*, Guér., one of the *Melolonthidæ* and a native of Venezuela. In regard to the immense space which separates the two insects, no explanation on the "struggle-for-life" hypothesis, causing *the one* to mimic some *other* form more powerful or less subject to destruction than itself, seems applicable here. The specimen described is in the collection of the British Museum, and appears to be a male; but of this I am not quite sure.

Fam. Anthribidæ.

BYTHOPROTUS.

Caput exsertum, subconicum, oculis rotundatis, integris. *Rostrum* subelongatum, bicarinatum, apice emarginatum. *Antennæ* (in fovea insertæ) longiusculæ, compressæ, articulis sulcatis, clava brevi, vix crassiore. *Prothorax* subelongatus, lateribus rotundatis, antice angustior, carina subbasali ad latera continuata. *Pedes* elongati, antice longiores, tarsorum articulo primo longissimo. *Prosternum* elevatum, postice productum.

This remarkable genus belongs to Schönherr's second subdivision of the Anthribidæ; but at present it would be difficult to say what are its precise affinities. In contour, perhaps, it

* *Hathlia* (Dej.).

approaches most nearly to *Ectatotarsus*. No doubt many new and intermediate forms remain to be brought to light from among the numerous islands of the Pacific, few of which have as yet been visited by the naturalist, but every one of them probably having its own endemic species*.

Bythoprotus lineatus.

B. niger, subnitidus, albo lineatus; prothorace corrugato, metallico-viridi; elytris basi albo maculatis.

Black, slightly shining, with remotely scattered, greyish-white, squamulose hairs, occasionally collected together and forming lines; head closely punctured, a line over each eye, and another in front; antennæ compressed, shorter than the body, inserted in a large deep fovea, the basal joint short, ventricose, the second about the same length, obconical, the third three times, the rest to the eighth twice the length of the second, and all, except the basal, fluted on both sides, the last three together not longer than the third, and scarcely thicker than the rest; prothorax very slightly convex, finely corrugated transversely, dull metallic green, with five narrow longitudinal lines; scutellum small; elytra nearly covering the abdomen, rather short, broadest at the shoulders, the sides rounded, a large white spot at the base, and six lines on each, which are united at the apex; legs black, claws deeply bifid; body beneath smooth, glossy greenish black, last abdominal segment with a strong tooth on each side; pro- and mesosterna elevated, continuous. Length 9 lines.

LI.—*A Catalogue of the Zoophytes of South Devon and South Cornwall.* By the Rev. THOMAS HINCKS, B.A.

[Continued from p. 310.]

[Plate XVI.]

Fam. *Diastoporidae*, Busk.

1. *DIASTOPORA*, Lamouroux.

D. obelia, Fleming.

Very common, on shells, &c., from moderate depths and from deep water.

* M. le père Montrouzier, a French missionary, has been for some time sending collections from some of these islands—Woodlark, Lifu, Balade, Art, &c.—to Paris, and they are being published in the 'Annales' of the French Entomological Society. They appear to be, almost without exception, new to science.

2. PATINELLA, Gray.

P. patina, Lamarek.

Very common, on shells, stones, &c., from moderate depths to 40 fathoms.

From Torbay and from deep water off the Cornish coast, I have very beautiful specimens, which are proliferous in habit, bearing the young on the margin of the cup. In one case as many as five are present, occupying the greater portion of the edge of the disk. A similar condition is met with in the *P. prolifera* of Mr. Busk's 'Monograph on the Crag Polyzoa,' and may prove to be common throughout the genus. It has never come under my observation, however, except in the case of the specimens to which I have referred, nor have I met with any account of its occurrence in a recent species. The cup in this proliferous form is deep and funnel-shaped, and stands erect, being attached by only a small portion of the base. The young are developed on the cellular border, just within the basal lamina.

Dr. Johnston states that the cells of this species have "a plain circular aperture." But both the upper and lower margins are frequently produced into a strong mucro, the orifice appearing bifid when viewed sideways.

3. DISCOPORELLA, Gray.

D. flosculus, n. sp. Pl. XVI. fig.

Polyzoary discoid, bordered with a thin margin; cells much raised, with a strong mucro on the upper edge, united together in regularly radiating rows, alternately longer and shorter, which are separated by reticulated spaces; the centre of the disk a depressed area, reticulated, with two or three large oblong openings placed near the edge of it.

Not common, on weed and shell: Brixham; Salcombe Bay.

The polyzoary forms a circular convex disk, about $\frac{1}{8}$ inch, or rather more, in diameter, resting on a thin base, which is adnate throughout; the entire surface is reticulated. The cell-tubes are much raised, and united together in radiating rows, with reticulated grooves between them. The uppermost cell-tubes are the longest, and they gradually diminish in height as they approach the margin. The rows of cells are alternately longer and shorter, the former radiating from the border of the central area to the margin of the disk, the others extending only about half the distance. The upper edge of the cells is strongly mucronate. At the top of the polyzoary there is a somewhat concave area, closely reticulated, and with a variable number (generally

three) of oblong orifices, with raised margin, the nature of which I have had no opportunity of determining.

I was at one time inclined to regard the *first* of the varieties of *Tubulipora hispida* described by Johnston (p. 269) as identical with the *Discoporella flosculus*; but I am now convinced that he had in view the early state of *Heteroporella hispida*, which is at first a simple subconical disk, somewhat "dimpled" at the centre, with radiating rows of cells, which are but little elevated, and are "closely compacted near the circumference." The large adult specimens seem to be formed by successive buddings from the margin, the cluster of disks thus produced gradually coalescing so as to constitute a composite structure, with many papillary prominences studding the surface.

In *D. flosculus* the polyzoary is always simple, circular in shape, and of small size.

[Coast of Labrador, on weed.]

4. HETEROPORELLA, Busk.

H. hispida, Fleming.

Discopora hispida, Fleming, Brit. Anim. 530.

Tubulipora hispida, Johnston, Brit. Zoopl. 268, pl. 47. figs. 9, 10, 11.

Discopora hispida, Couch, Cornish Fauna, 109, pl. 19. fig. 1.

?*Heteroporella radiata*, Busk, Crag Polyzoa, 127, pl. 19. fig. 2.

Very abundant on stones, shells, &c., from moderate depths to deep water (60 fathoms).

The *Discopora hispida* of Fleming, a very common British species, must be assigned to the *Heteroporella* of Busk, a genus lately constituted for the reception of two Crag forms, which agree with the *Heteropora* of De Blainville in having "openings of two distinct kinds" on the surface, but differ from it in being adnate and incrusting, instead of erect. One of these fossil species, the *H. radiata*, appears to be identical with the present form. The mouths of its cell-tubes, indeed, are described as "simple and even with the surface," whereas in *H. hispida* they are raised and spinous in the perfect state. But even in recent specimens the erect portions are often wanting, and the surface is uniformly porous.

Dr. Johnston has described two varieties of his *Tubulipora hispida*, which are only, I believe, the young and adult states of the *Discopora hispida* of Fleming. His figures (pl. 47. figs. 9, 10, 11) are indifferent representations of this form.

The *Discopora hispida* of Couch's 'Cornish Fauna' is also Fleming's species.

I am indebted to Mr. Holdsworth for drawing my attention to the fact that it belongs to the genus *Heteroporella*.

H. hispida often attains a very considerable size. A specimen

from deep water off the Cornish coast measures more than $1\frac{1}{2}$ inch in circumference, and is covered with about thirty of the little "papillary eminences" which are so characteristic of the species. The intercellular pores present the pretty stellate appearance which Mr. Busk has noticed in *Heteropora clavata*.

[Isle of Man; Rothesay Bay, mouth of the Clyde; Shetland, &c.]

Fam. Crisiadæ.

1. CRISIA, Lamouroux.

1. *C. eburnea*, Linnæus.

Common.

2. *C. denticulata*, Lamarek.

Very common: abundant in Salcombe Bay, &c.

2. CRISIDIA, Milne-Edwards.

C. cornuta, Linnæus.

Common in Devon; Cornwall (*Couch*).

The only *Crisidia* which I have met with is the form in which the spine springs from the side of the cell beneath the aperture. This is the *C. setacea* of Couch, but is probably only a variety of the *C. cornuta*.

Suborder Ctenostomata, Busk.

Fam. Alcyonidiadæ.

1. ALCYONIDIUM, Lamouroux.

1. *A. gelatinosum*, Pallas.

Salcombe Bay, Devon; Cornwall, "on shells and stones from deep water; not rare on the south and south-west coast" (*Couch*).

2. *A. hirsutum*, Fleming.

Common between tide-marks. This species attains a large size on the South-Devon coast, forming very beautiful palmate masses, variously lobed.

In its crustaceous state, it is the *Cycloum papillosum* of Hassall.

3. *A. parasiticum*, Fleming.

Not common: Salcombe Bay; Cornwall.

4. *A. hexagonum*, Hincks.

Very common, on stones, weed, &c., between tide-marks, and also from moderate depths.

5. *A. polyoum*, Hassall.

Torbay, between tide-marks, encrusting shells of *Trochus cinereus*.

The form here intended, which I believe to be distinct from *A. hexagonum*, seems to agree with the *Sarcochitum polyoum* of Hassall. There is no sufficient ground for separating it from the genus *Alcyonidium*.

2. ARACHNIDIA, nov. gen.

Polyzoary membranaceous, forming a delicate network; cells separate, distant, adnate, connected by a creeping, anastomosing fibre.

A. hippothooides, n. sp. Pl. XVI. fig. 2.

Cells lozenge-shaped, or rudely fusiform, of a light horn-colour, with fibrous processes round the margin; orifice near the upper extremity of the cell.

On shell, Torbay.

The *Arachnidia* may be regarded as an *Alcyonidium* with its cells detached from one another, and held together by a delicate thread, instead of being immersed in a fleshy crust. Occasionally the cells are massed together, but usually they are separated by considerable intervals, and connected by a fibre which passes off from the two extremities and from about the middle of each side. The habit of the *Hippothoa* is curiously imitated by this species.

The form of the cells is somewhat irregular, and the fibrous processes round the margin are not easily detected, unless the specimen can be viewed with transmitted light. When the *Arachnidia* spreads over the surface of a shell, it is almost impossible to make them out.

[On a *Cyprina*, dredged off the Isle of Man (*T. H.*); on shell and the test of an Ascidian, Lulworth Cove (*Mr. Alder*).]

Fam. Vesiculariadae.

1. VESICULARIA, J. V. Thompson.

V. spinosa, Linn.

Not uncommon amongst the Brixham trawl-stuff; "deep water off the Deadman, rare" (*Couch*).

[Filey, Yorkshire; Lytham, Lancashire; Llandudno, North Wales.]

2. AMATHIA, Lamouroux.

A. lendigera, Linn.

Very common: in great luxuriance on *Halidrys siliquosa*, under the rocky shores of Salcombe Bay, &c.

3. *BUSKIA*, Alder.*B. nitens*, Alder.Dredged in Salcombe Bay, on *Calicella dumosa*.

[Filey, Yorkshire; Llandudno, North Wales.]

4. *VALKERIA*, Fleming.1. *V. Cuscuta*, Linn.

Not uncommon, in tide-pools, on Coralline and weed; Torquay; near Plymouth, of remarkable size and beauty, &c.

[Llandudno, on *Halidrys*; Filey; Ramsay, Isle of Man.]2. *V. Uva*, Linn.Common, under stones, on Corallines, *Sertularia pumila*, &c., between tide-marks.3. *V. pustulosa*, Ellis & Solander.Dredged abundantly in Salcombe Bay; "Fowey Harbour, and off Goran, Cornwall, very rare" (*Peach*).

This species grows in dense arborescent masses, and sometimes attains the height of 4 inches.

[Llandudno, North Wales; Filey.]

4. *V. tremula*, n. sp. Pl. XII. fig. 9.

Stem creeping; cells elongate, tapering to a point below, very small and slender.

Salcombe Bay, on *Flustra chartacea*.

This is a very minute species. It may be known at once by its delicate tapering cells, which terminate in a point below. They seem to be very slightly attached to the creeping stem, and droop a little to one side when the polypide retracts itself.

I have met with what I take to be the same species on shell dredged off the Isle of Man.

5. *MIMOSELLA*, Hincks.*M. gracilis*, Hincks. Pl. XVI. fig. 1.Not rare in the Laminarian zone, always on *Halidrys siliquosa*: Salcombe Bay; Torbay, under Berry Head; Plymouth; "Polperro and Goran" (*Couch*).

In the original description of this beautiful species ('Annals' for November 1851) I have stated that the polypides are furnished with a gizzard. From subsequent observation, however, I am inclined to doubt whether this is the case or not. The point must be reserved for future determination.

The description and figure of *Valkeria Cuscuta* in 'The Cornish

Fauna' must be referred to the *Mimosella*. Mr. Couch himself remarks upon the discrepancies between his own account of this species and those given by Ellis, Fleming, Thompson, and Johnston, and says of the form which he had in view, "If we suppose their descriptions to have been taken from injured specimens, this in a similar condition closely resembles them; otherwise it must be considered a new species." He does not notice the mobility of the cells, or their biserial arrangement; but the characters which he gives are those of the *Mimosella*, and not of the *Valkeria*. His figure also is evidently intended to represent the former.

In Dr. Johnston's collection, now deposited in the British Museum, there are specimens of the *Mimosella* which he had received from Mrs. Griffiths, ranked under *Valkeria Cuscuta*.

Mimosella gracilis grows in tangled masses on the *Halidrys*.

6. BOWERBANKIA, Farre.

B. imbricata, Adams.

Both forms occur—the *densa* of Farre, and the erect and branched variety, which Mr. Alder is inclined to consider specifically distinct. The former is met with abundantly in tide-pools, growing in small tufts on the stems of *Corallina officinalis*, and creeping over the under surface of stones between tide-marks. The latter is also littoral, and is sometimes as much as 3 inches in height. In colonies of the variety *densa*, cells are commonly found, laden with large yellow ova, one or two being present in each. In such cases the polypides have always disappeared, the eggs about filling the interior.

7. AVENELLA, Dalyell.

1. *A. gigantea*, Busk.

Farrella gigantea, Busk, Mic. Journ. vol. iv. p. 93, pl. 5. fig. 2.

Salcombe Bay, profusely investing *Salicornaria farciminoides*. The specimens are inferior in size to Mr. Busk's from Tenby, but otherwise agree exactly with his description.

2. *A. dilatata*, Hincks, Microsc. Journ. vol. viii. p. 279, pl. 30. fig. 7.

On *Flustra*, probably not uncommon.

There has been much confusion about the species of *Avenella*. The form here intended is a common parasite of various kinds of *Flustra*. I have it also spreading over shells dredged off the Isle of Man. In the latter habitat, the spinous expansions of the creeping fibre, which constitute a striking character, are well displayed; but on the *Flustra* they are detected with diffi-

culty. The cells, however, are sufficiently well marked. They are stout, sessile, of equal size throughout, somewhat quadrangular, opaque, and of a very dark-brown colour when dried. This seems to be the form which Mr. Alder has identified with the *Avenella fusca* of Dalyell (Northumberland Catal. p. 69). The latter, however, I have no doubt, is a distinct species. Its cells are smaller and more slender, with a tendency to assume a bent form. They taper slightly both towards the base and the upper extremity; and the opacity is due to a peculiar constitution of the ectocyst, resembling that which Mr. Busk has described in the case of *Farrella gigantea* (Microscop. Journ. vol. iv. p. 93). The creeping fibre is also perfectly simple. I have specimens from Professor Wyville Thomson, which agree in all respects with Sir John Dalyell's figure.

Avenella gigantea differs from the *A. fusca* in size and in the shape of the cell.

Mr. Busk unites *Avenella* with *Farrella*. But perhaps the species with sessile and opaque cells and numerous tentacles are entitled to distinct generic rank.

Order PHYLACTOLÆMATA, Allman.

Suborder Pedicellinea, Gervais.

Fam. Pedicellinidæ.

PEDICELLINA, Sars.

1. *P. echinata*, Sars.

Very common: between tide-marks; on *Vesicularia* from the Brixham trawl-stuff, &c.

2. *P. Belgica*, Van Beneden.

Exmouth, on weed in rock-pools.

[Filey, between tide-marks; Llandudno.]

3. *P. gracilis*, Sars.

Common: under stones, Salcombe; Torbay (8 fathoms), &c. [Lamlash Bay; Filey; Llandudno; Ramsay, Isle of Man.]

Suborder Lophopea, Allman.

Fam. Plumatellidæ, Allman.

PLUMATELLA, Lamarck.

P. repens, Linn.

Stoke, near Plymouth.

I have not had the opportunity of investigating the freshwater Polyzoa of Devon and Cornwall; and none are included in

Couch's 'Cornish Fauna' but the *Fredericella Sultana*, which has been found near Penzance. There can be little doubt, however, that many of the species might be discovered by careful examination.

EXPLANATION OF PLATE XVI.

Fig. 1. *Mimosella gracilis*, Hincks, nat. size.

Fig. 2. *Arachnidia hippothoides*, n. sp., magnified : 2*a*, a single cell, more highly magnified.

Fig. 3. *Discoporella flosculus*, n. sp., nat. size and magnified : 3*a*, side view of cells ; 3*b*, one of the tubular orifices in the centre of the disk.

LII.—On the supposed Bilateral Symmetry of the Ctenophora.

By FRITZ MÜLLER*.

IN radiate animals we can distinguish *only* the front from the back, *or* the top from the bottom ; in bilateral animals we can *simultaneously* distinguish the front from the back, *and* the top from the bottom. Radiate animals are divisible into symmetrical parts through as many planes as there are rays present ; bilateral ones only into symmetrical halves through a single plane : radiate animals have an axis at the intersection of the above planes ; bilateral ones only the median plane, and no axis. In radiate animals only the parts situated in the axis can be present singly ; all the parts in the middle and on the borders of the rays are repeated to the number of the rays, all the other parts to twice this number. In bilateral animals all parts situated in the median plane may occur singly, and all parts out of this plane exist in pairs.

If the divisional planes of the rays be allowed to turn round the axis, retaining their relative position, the animal will constantly be cut into congruent parts ; bilateral animals are not divisible into congruent parts. Each individual ray of a radiate animal is bilaterally symmetrical ; bilateral animals are not divisible by planes parallel to their longitudinal direction into fragments which are again bilaterally symmetrical.

When the rays are in pairs, therefore, in 2-, 4-, or 6-rayed animals, every plane passing through the axis cuts the body into congruent halves, and each of these sections is again cut through the axis into congruent halves. Bilateral animals (as also Radiata with an uneven number of rays) are not divisible into congruent halves ; a right half cannot be replaced by a left one, nor can an entire animal be made out of two right halves of congruent animals. If, on the other hand, two even-rayed animals were cut in the same way into congruent halves, any two

* Translated by W. S. Dallas, F.L.S., from Wiegmann's Archiv, 1861.

of these four halves might at pleasure be united to form a complete animal.

Every plane carried through the middle of a ray, as also every divisional plane between two rays, divides even-rayed animals into bilaterally arranged halves. The halves of a bilateral animal, considered separately, are no longer bilaterally arranged.

The series of these characters which separate sharply and abruptly the radiate from the bilateral arrangement of the animal body might readily be carried much further. I break it off here; for already I hear the question, What is the use of this idle enumeration of self-evident differences between things which no one can confound together? Is it not sufficient to have seen a starfish by the side of a crab, or even merely to hear the denominations radiate and bilateral, to prevent our ever doubting which of the two modes of arrangement we have before us? This may be supposed, but evidence to the contrary is furnished, amongst other things, by the Ctenophora. According to all the characters adduced, and however the idea may be otherwise analyzed mathematically, they appear to be radiate and, indeed, *biradiate* animals, and exhibit this structure stamped in the most perfect regularity and most rigidly followed throughout, without the slightest trace of a transition to bilateral arrangement; and yet the prevailing opinion of the day appears to be in opposition to this. Burmeister expresses himself with cautious doubt:—"The Ctenophora appear to be constructed upon both types, yet a regular oval form predominates*." Others regard them positively as "bilaterally symmetrical animals," or as a transition-form "from the radiate type to the bilaterally symmetrical." These are the views of Agassiz†, Vogt, and Gegenbaur. The weighty suffrages of such opponents urged me to a somewhat detailed exposition of the subject, in itself certainly extremely simple. With this exposition of the differences between radiate and bilateral animals my evidence in favour of the position of the Ctenophora among the former is already given. It remains for me to discuss the reasons for the opposite opinion, which, unfortunately, I cannot find brought into connexion in any work accessible to me.

The first inducement to regard the Ctenophora as bilateral animals, or as intermediate between these and radiate animals, has probably been furnished by "the laterally compressed" form of the body of many species, and especially the greatly elongated ribbon-like form of *Cestum*, in which Vogt finds the "symmetrical type" most distinctly displayed, and Gegenbaur considers that "the bilateral symmetry attains its culminating

* Geschichte der Schöpfung, 6. Aufl. p. 330.

† According to the 'Jahresberichte' of V. Carus and Leuckart.

point." If this remarkable form of the *Cestum Veneris* might furnish the inducement to a new investigation of its right to stand as a radiate animal, it cannot, however, be made available as evidence to the contrary, any more than the globular form of a rolled-up *Spharoma* can exclude that animal from the bilateral series. If the Ctenophora be regarded as biradiate animals, this ribbon-like form, moreover, loses all its remarkableness; *Cestum* then places itself in the neighbourhood of the *Cydidippæ* with a circular transverse section, in exactly the same way as the long-rayed *Asteriadae* and *Ophiuræ* take their place in the neighbourhood of the globular *Echinus*.

A second reason for the assumption of a "bilateral symmetry" appears to have been furnished by the duality of various parts, such as the orifices of the funnel, the oral lobes, the gastric vessels, tentacular filaments, &c. "Even in the otherwise radiately constructed Beroës" Gegenbaur finds "the bilateral symmetry indicated" in the two orifices of the funnel*, and supposes the two tentacular filaments of *Cydidippe* to be arranged "in accordance with bilateral symmetry†." It is true that most of the parts of bilateral animals are present in duality; but the distribution of these duplicate parts, in the Ctenophora, upon two planes perpendicular to each other, far from being a proof of bilateral symmetry, is rather something perfectly irreconcilable therewith, and, combined with the quadruplication of all parts exterior to these planes, is a certain characteristic of *biradiate* arrangement. However, quite independent of the characters of radiate and bilateral animals stated above, it is a matter of wonder that the contradiction which lies in regarding the orifices of the funnel and the tentacular filaments as both bilaterally symmetrical has escaped notice. If it be the orifices of the funnel, then, in *Mnemia*, for example, the narrow sides and oral lobes lie right and left, the broad sides with tentacular filaments‡ and gastric vessels above and below. If it be the tentacular filaments, the broad sides and gastric vessels are right and left, the narrow sides, oral lobes, and orifices of the funnel above and below. One supposition reduces the other *ad absurdum*. In both suppositions, moreover, in contradiction to the most essential characteristic of bilateral structure, there is no distinction of dorsal and ventral surfaces.

A further remark of Gegenbaur's has always been unintelligible to me. In the Ctenophora the radiate type of the Coelenterata is said to pass over into the bilaterally-symmetrical type "by a preponderating development of the individual parts taking

* Wiegmann's Archiv, xxii. p. 170.

† Loc. cit. p. 176.

‡ These are indeed very minute, but not wanting, in *Mucmia Schweiggeri*, Eschsch.

place on two symmetrical halves of the body*.” As the animal has only two halves, and consequently the two halves with preponderating development of parts constitute the entire animal, one does not understand where the parts remaining backward in their development can find a place. But if we were to understand by the term “halves” only opposite parts of the body (and one is accustomed to find a perfectly new mathematical language in works on natural history), the relation occurring in the Ctenophora, and indicated as in favour of “bilaterally symmetrical type,” would not be any better expressed. Or are the orifices of the funnel and the oral lobes preponderatingly developed gastric vessels and tentacular filaments, or *vice versâ*? Or are our own arms and legs preponderant developments of some parts of our dorsal and ventral surfaces?

In his ‘Zoologische Briefe’ †, Carl Vogt has explained, in his usual simple and luminous manner, the distinctions between radiate and bilateral structure. According to this representation of his own, he ought to have indicated the Ctenophora unconditionally as perfectly radiate in their structure. And yet even he has allowed himself to be led astray by the “long transverse ribbon” of the *Cestum Veneris*, which, as he remarks in his ‘Ocean und Mittelmeer,’ “may be divided, by a cut carried transversely upon the axis of the band, into two perfectly similar halves, in which not the least trace of a radiate arrangement can be detected:” it is sufficient to add, “any more than in an individual ray of any other radiate animal,” in order to show that the indisputable fact proves nothing adverse to the radiate construction of animal. And if we further indicate that the halves are indeed *perfectly similar*, that is to say, not merely symmetrical, but congruent, and that each of them displays a bilateral arrangement, a peculiarity is pointed out which certainly occurs in all biradiate animals, but not in a single bilateral one.

But are not the Ctenophora, although perfectly radiate animals, still, as being *biradiate*, more nearly allied to the *bilateral* animals than other polyradiate forms, and consequently to be regarded as intermediate? I think not. The apparent similarity, existing only in name, disappears as soon as we exchange “bilateral” for “non-radiate.” On the contrary, the smaller the number in which an animal or vegetable organ exists, the more certainly is it usually retained. And so in this case it might be expected that the smaller the number of rays, the more rigidly will the radiate structure be carried out, and that a transition into other modes of arrangement will occur rather with a high than with a low number of rays. Experience confirms this conjecture: leaving

* Grundzüge der vergl. Anatomie, p. 67.

† Bd. i. pp. 64 & 65.

out of consideration the Echinodermata, in which Johannes Müller's acuteness everywhere recognized traces of bilateral arrangement, such are to be found amongst the Cœlenterata, for example, in the 12-rayed *Philomedusa Vogtii*, and in the young brood of the equally many-rayed *Cunina Kollikeri*. The radiate structure is exhibited, on the contrary, with the greatest strictness in many four-rayed Discophora, and in the biradiate Ctenophora, which therefore prove, even in this respect, to be true Cœlenterata.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

January 14, 1862.—Dr. J. E. Gray, F.R.S., V.P., in the Chair.

DESCRIPTION OF SPHYROCEPHALUS LABROSUS*, A NEW BAT FROM OLD CALABAR RIVER, WESTERN AFRICA. BY ANDREW MURRAY, ASS. SEC. R. HORTICULTURAL SOCIETY.

PTEROPINI.

SPHYROCEPHALUS, nov. gen.

Dental formulæ:—

Incisors.	Canines.	Molars.	
		Premolars ?	True molars ?
$\frac{4}{4}$	$\frac{1}{1}$	$\frac{1}{2}$	$\frac{2}{3}$

Head very large and oblong; the lips largely developed and expanded. Ears rather large, without tragus. Thumb and index-finger of hand unguiculate, the other fingers without claws. Tail wanting.

SPHYROCEPHALUS LABROSUS, sp. nov.

Brown, with a few whitish hairs at the base of the ears. The head very large, massive, half as long as the whole body, oblong, and as broad at the muzzle as at the top of the head, with some resemblance to a hammer, whence the name hammer-headed (*Sphyrocephalus*), rather more than twice as long as deep; ears rather large, destitute of tragus; eyes rather large; eyelids provided with eyelashes; nostrils large and tubular; lips extraordinarily developed;

* Since this paper was in print, the last number of the 'Proceedings of the Academy of Natural Sciences of Philadelphia' has been received in this country (the first copies arrived on 19th February, 1862); and in it I find a description of a new Bat, which probably belongs to this species, by Dr. Harrison Allen (Proc. Acad. Nat. Sc. Phil. July 1861, p. 156). It is said to be taken from a specimen collected by M. Du Chaillu, and is named by Dr. Allen *Myotis monstrosus*. If it is the same species, of course Dr. Allen's name must take precedence. His description does not quite correspond with mine, but, judging from the description of the nose, may, perhaps, have been taken from a dried skin, whereas mine is from a fine example in spirits. M. Du Chaillu has exhibited no specimen of this Bat in England.

both upper and lower lips of a very smooth semi-mucomembranous texture, corrugated and tuberculated at the margins; the upper lip with a tuberculated prominence in the line of the two outer incisors, and a more elongated tuberculated ridge further up, in the line of the two inner incisors; the external lateral margin expanded into a sort of stiff semi-cupshaped flap with a tuberculated edge, rising to meet the nostril and then descending, following its lower edge, and terminating in a curved scroll-like coil in the nostril.

The same semi-mucomembranous lip is spread over the front of the lower jaw, forming a sort of chin. The skin in the neighbourhood of the lips, and extending upwards and backwards along the nasal bones, is covered with the same sort of fine velvety down which surrounds a horse's nostrils; the hair on the rest of the head is flocky; on the downy portion there are on the sides of the upper lip three rows of papillæ, each with a long whisker-hair springing from it. In the specimen before us these papillæ are arranged four in the two first rows and three in the last; similar papillæ and hairs run up the downy space covering the long nasal bones, in three rows, past the eyes and quite to the forehead, numbering each nine or ten papillæ, the middle row being shorter than the two others. The gape of the mouth is large, extending back fully a third of the head; the lip does not encroach on the outside of the face along the gape; it is only directly in front that it is so much developed; the upper lip is connected with the gum by a broad thick ridge uniting them together in the line of the symphysis of the intermaxillary bones.

The disposition of the teeth is as follows:—

They are all well separated from each other, none touching each other except, perhaps, the last molars; the incisors of the upper jaw are minute rounded points; in the lower jaw they are equally minute, but transversely oblong and bilobed. The canine teeth in both are well developed and of the usual form; beyond the canine there is a minute tooth (a mere point) in the lower jaw which is wanting in the upper jaw; the next tooth beyond it is almost exactly of the form of the canine, and is probably a pre-molar; the remaining teeth, two in the upper and three in the lower jaw (probably true molars), have their crown divided longitudinally; in the upper jaw each ridge slopes backwards, in the under jaw the external ridge is bilobed. The palate has strong, elevated, transverse ridges running across from interspace to interspace between each tooth. The tongue is rather large, and covered with a sort of tessellated pavement of large flat papillæ; it is free very far back. Under it and lying in the hollow of the mouth, occupying the whole breadth for a short space in front between the rami of the lower jaw, is a very curious membrane fringed with slips or plaits—a sort of second tongue, calling to recollection a somewhat similar organ or structure under the tongue of the *Loris* and *Lemur*. In these it assumes the form of an aponeurotic lamina, which is divided at its anterior thinner end into filaments or slips. "This arrangement (a development of the *frænum* of the tongue)," says Van der Hoeven, "has been described incorrectly, in my judgment, as though the tongue were double, or even as if a bird's tongue

were under the mammalian tongue." It may be a development of the frænum, because two things connected together, although at opposite ends, may always be said to be parts of the same thing however distant they may be. But I would only observe that in the present instance the frænum of the tongue is situated very far back, and it seems to me that it may just as possibly be a development of the floor of the mouth as of the frænum of the tongue. I do not suppose that Dr. Van der Hoeven would think it necessary to look elsewhere than to the walls of the œsophagus to find the structure from which the elongated papillæ lining the œsophagus, in the hawk-billed turtle for instance, had been developed. There is a tendency to similar structure in other parts than the tongue in many animals—on the palate and back of the mouth, for example; and I should not be disposed to seek further than the place from which it springs for the source of this development. It does not extend much further back than the lower canine teeth; but there is a slight plait or perceptible line running on each side all the way to the back of the mouth, giving the appearance of a second thin flat tongue lying in the hollow of the mouth, tied down like the tongue of a crocodile; but the separation here is a mere trace, and it is only the fringed margin in front which is free.

The neck is distinct, and the skin has the appearance of having some cellular space between it and the muscles.

The body is oblong and compact; the ribs descend far, and the lower ribs are very large; the stomach is moderate in size, furnished internally with several large transverse folds; the small intestines are not very long; there is no cæcum.

The arms have the thumb and index unguiculate, the rest of the fingers are without claws; the thumb has two phalanges, the rest have three phalanges. The thumb is united to the wing by a membrane stretching on both sides over the whole of the proximal and half of the distal phalanx; the proximal phalanx of the thumb is shorter than the distal. The winged membrane is not extended across the back, but is very ample; the winged space between the third and fourth fingers, and between the fourth and the body, has in its middle numerous longitudinal bundles of muscular fibre interwoven without attachments, and one or two similar transverse bundles; these are probably for the purpose of assisting in the folding of the wing. Along these bundles of muscular fibre the membranous wing is closely wrinkled; and there is little doubt that they will also strengthen the membrane where they occur.

The hind feet are uniform and all unguiculate; they are united to the body by an interfemoral membrane, which has a single large bundle of muscular fibres stretching obliquely across from the foot to the coccyx.

The testicles are situated under the skin on each side of the male organ, and are round.

There is no tail.

The length of the whole body, in the specimen from which the above description is taken, is nearly 7 inches; the length of the

head $3\frac{1}{4}$ inches, its depth about $1\frac{1}{4}$ inch. The stretch of wings is 28 inches across.

The most remarkable features in this animal are its large hammer-shaped head, and the great external development of its lips. Its whole structure is essentially that of a Pteropine Bat, with some modifications showing a tendency towards the *Rhinolophi*. No species having any of the nasal appendages peculiar to that section of the Bats has yet been found among the Pteropine Bats. They are strictly frugivorous, and have the nose like that of a fox or dog. The present species, although it has not any nasal appendages, has labral expansions which may possibly be analogous to them, and the animal may possibly have peculiar habits to which the structure of these organs is especially adapted.

Unfortunately, in the only specimen yet received, the stomach and intestines were wholly empty; so that we cannot speak of its food with positive certainty. The teeth are Pteropine in character, but not so absolutely so as to preclude the possibility of this creature being at least partially insectivorous, the molars showing a tendency to mammillation on the external side of the longitudinal ridges into which they are separated. The large folds in the interior of the stomach seem to point to a vegetable diet.

The sublingual fringed membrane is also an interesting peculiarity, not only on account of its rarity, but because one of the few other instances where it has been noticed is in an animal having no one thing in common with the present, except that of living in the same country. We sometimes see this happen; an abnormal structure or peculiarity occurring in an animal restricted to one country will be found repeated in some other animal of that country no way connected with or allied to it.

This Bat was sent to me by my excellent friend, the Rev. Wm. C. Thomson, one of the missionaries of the United Presbyterian Church of Scotland, stationed at Old Calabar—a true Christian, an excellent naturalist, and one whose devotion to the cause he has undertaken, viz. the amelioration of the African negro, has been proved by the greatest sacrifices from his youth upwards.

Prof. Owen communicated the first part of his paper on the Aye-aye (*Chiromys madagascariensis*, Cuv.), including an introductory historical sketch of its discovery and the various opinions respecting its nature and affinities set forth by naturalists from Buffon to the present time. After commenting on the chief of these, the author proceeded to narrate the circumstances under which the subject of his descriptions, a nearly full-grown male, had been obtained from Madagascar, and prepared for dissection, by the Hon. H. Sandwith, M.D., C.B., whilst Colonial Secretary at the Mauritius. The habits of the Aye-aye during the period in which it lived a captive at the Mauritius with Dr. Sandwith, and also the habits of other individuals that for a time were kept alive in the island of Réunion, by MM. Liénard and Vinsor, in 1855, were next noticed. The specimen submitted to Prof. Owen, having been transmitted well preserved in

spirit, afforded the means of a minute external description. The extremities were described as follows:—"The fore leg turns freely in the prone and supine position; it is pentadactyle: the innermost digit stands out at an acute angle with the index, and is opposable to the other digits, making a prehensile hand, but in a less perfect degree than in the old-world or 'catarrhine' quadrumana. The second, fourth, and fifth digits have the ordinary thickness, the fourth being almost twice the length of the second. The third or middle finger is singularly attenuated, is rather shorter than the fourth digit, and is terminated by a slender curved claw. It is this seemingly atrophied digit which the Aye-aye inserts into the burrows of the wood-boring caterpillars, after it has gnawed down to and exposed them by its strong fore teeth, in order to extract the grub. The hind limb is longer than the fore limb, and is terminated by a more perfect hand—the 'hallux' or thumb being stronger, and set at a more open angle with the other toes, and these being more similar to each other in length and thickness: the thumb has a flat, broad nail." Prof. Owen observed that, from the external characters of the Aye-aye, it might be inferred that it was of arboreal habits, the limbs being constructed chiefly for grasping, especially the hinder pair, as in all good climbers. The circular open eye, large iris, and wide pupil, reducible to a minute point when contracted, indicated a climber of nocturnal habits. The large and perfect ears bespoke the acuteness of their sense. The tail, long and bushy, but not prehensile, might add to the protective non-conducting covering of the well-clothed body during sleep. Prof. Owen then proceeded to describe the skeleton of the Aye-aye.

January 28, 1862.—Dr. J. E. Gray, F.R.S., V.P., in the Chair.

Professor Owen concluded the reading of his memoir on the Aye-aye (*Chiromys madagascariensis*), which had been adjourned from the last meeting of the Society. The portions of the structure of this animal successively examined were the dentition, the muscles, the brain, the digestive organs, the organs of circulation and respiration, and the renal and genital organs. The author then proceeded to the comparison of its external characters, its osteology, and its internal structure with those of the Lemurs and Rodents, and showed that in a variety of particulars its nearest approach was to members of the lemurine group. In ordinary zoological or external characters its nearest allies were certain Galagos of Africa (*Otolienus crassicaudatus* and *O. Alleni*). In conclusion, he entered into the evidence afforded by the peculiarities of this animal on the question of the origin of species, and, after showing the arguments in favour of the derivative hypothesis and those against its mode of operation, as propounded by Buffon, Lamarck, and Darwin, came to the conclusion that, whilst the general evidence on this subject was in favour of creation by law, he was compelled to acknowledge ignorance as to the mode in which such secondary causes might have operated in the origin of *Chiromys*. At the same time he fully admitted that the attempts to dissipate the mystery which environed the origin of species, whether successful or not, could not but be fraught with great collateral advantages to zoological science.

February 11, 1862.—Dr. J. E. Gray, V.P., in the Chair.

Mr. Gould exhibited a specimen of a Lyre-bird (*Menura*) from Port Philip, and pointed out the characters in which it differed from the closely allied *Menura superba* of New South Wales. Mr. Gould proposed the name *Menura Victoria* for this new species.

The following papers were read :—

ON THE ASSUMPTION OF THE MALE PLUMAGE BY THE FEMALE OF THE COMMON PHEASANT. BY EDWARD HAMILTON, M.D., F.Z.S., F.L.S., ETC.

The late Mr. Yarrell, in a communication read before the Royal Society in 1827, "On the Assumption of the Male Plumage in Female Pheasants," drew attention to the fact that this anomaly was not necessarily the accompaniment of age—*i. e.*, in old hen-birds which had done laying; but states that it may occur sometimes from an original internal defect, sometimes from subsequent disease, and sometimes from old age. Dr. Butter, who had written previously on this subject, had stated that this peculiarity only occurred in old birds; and John Hunter, in "An Account of an Extraordinary Pheasant," had the same opinion. He considers that in such cases the female puts on the *secondary* properties of the male, and observes that some classes are more liable than others to this change. He goes on to state "that in animals just born, or very young, there are no peculiarities to distinguish one sex from the other, exclusive of what relates to the organs of generation, which can only be in those who have external parts; and that towards the age of maturity the discriminating changes before mentioned begin to appear, the male then losing that resemblance he had to the female in various secondary properties: this particularly applies to birds. It is evidently the male which at this time recedes from the female, every female being at the age of maturity more like the young of the same species than the male is observed to be; and if the male is deprived of the testes when growing, he retains more of the original youthful form, and therefore more resembles the female. From hence it might be supposed that the female character contains more truly the specific properties of the animal than the male; but the character of every animal is that which is marked by the properties common to both sexes, which are found in a natural hermaphrodite, as in the snail, or in animals of neither sex, as the castrated male or spayed female. They are curious facts in the natural history of animals, that by depriving either sex of the true parts of generation they shall seem to approach each other in appearances."

In some species of animals, that have the secondary properties we have mentioned, there is a deviation from the general rules by the perfect female, with respect to the parts of generation, assuming more or less the secondary character of the male. John Hunter, like Butter, considers that this does not arise from any action produced at the first formation of the animal, nor grows up with it, but seems one of those changes which happen at particular periods. He goes on to describe some hen-pheasants having the plumage in part of the

male, and says, "I found the parts of generation to be truly female, they being as perfect as any hen-pheasant that is not in the least prepared for laying eggs, and having both the ovary and oviduct." He says, "From what has been related of these birds we may conclude that this change is one of the effects of age, and obtains to a certain degree in every class of animals. We find something similar taking place even in the human species; for that increase of hair observable on the faces of many women advanced in life is an approach towards the beard, which is one of the most distinguishing properties of man. Thus we see sexes, which at an early period had little to distinguish them from each other, acquiring about the time of puberty secondary properties which clearly characterize the male and female,—the male at this time receding from the female, and assuming the secondary properties of the sex. The female at a much later time of life, when the powers of propagation cease, loses many of her peculiar properties, and may be said, except from mere structure of parts, to be of no sex, even receding from the original character of the animal, and approaching in appearance towards the male."

In the years 1858, 1859, and 1860 this peculiar alteration of structure in the female organs of generation in the Pheasants was particularly prevalent in some parts of England. I had the opportunity of examining many specimens, and was able completely to confirm Mr. Yarrell's views on this subject. Indeed, the majority of the birds were young females, many of them being birds of the year, some being in their first moult. I found also that the plumage varied and approached that of the male, not in accordance with the age of the bird, but with the amount of disease of the generative organs. The greater the destruction of the ovarium and oviduct, the nearer the plumage simulated to the male.

For example, in birds with the hen-plumage predominating, the ovarium and oviduct exist as in the fecundating hen, the small ova lying in considerable numbers in the ovarium, the ovarium and oviduct showing dark lead-coloured masses of disease.

In birds with the plumage of the male in a measure exceeding that of the female, the ovarium is considerably diminished in size, dark-coloured, and containing only a few blackened ova; the oviduct is spotted with dark patches, and considerably contracted.

And thirdly, in birds with the male plumage predominating over that of the female, the ovarium is reduced to a small dark amorphous mass, resembling coagulated blood; the presence of ova cannot be detected, and the oviduct is almost entirely obliterated at its junction with the ovarium. Thus it seems that there are three distinct phases in this peculiar abnormal state of the generative functions.

I have also noticed that, in most cases where the male plumage is in excess of the female, the tail-feathers are particularly long, some being as much as 19 inches in length.

Although Mr. Yarrell states that this condition of the female generative organs is not confined to the *Phasianidæ*, and that it has occurred in the gold and silver pheasants, partridges, pea-fowl, common fowl, common pigeon, king-fisher, and common duck, and that

other classes of animals are liable to an influence similar in kind, particularly among insects and Crustacea, yet this disorganization is rarely observed except among the *Phasianidæ*, and particularly when these birds are produced in a domestic state, *i. e.* on the present system of breeding pheasants in preserves. Very few *battues* take place in which some of these birds, generally designated mules, are not killed and mixed indiscriminately with the heaps of the slain.

As to the cause of this disorganization, if it occurred only in the old female, or if it were a common occurrence among birds either of different genera or of the same genus, it could be easily accounted for; but when it is generally found existing among a class of birds which are bred in vast numbers in a particularly artificial manner, it leads one to suppose that the cause must be connected with this condition. Whether the eggs laid by a number of females—to whom perhaps, from circumstances, too few males have been admitted—have been properly fecundated, and therefore the chick improperly formed, remains a subject for future consideration.

MISCELLANEOUS.

On Mesozoic Forms of Life in Australia.

To Wm. Francis, Ph.D., F.L.S.

MY DEAR SIR,—I learn from a correspondent at Melbourne, Mr. J. S. Poore, that during his visit to King George's Sound, Western Australia, he there dredged up, from 8 fathoms, a living Eucrinurite. The stem, which was attached to a stone, was about 6 inches long; the arms about $1\frac{1}{2}$ inch, of a beautiful rose-colour, or pink, fading to white.

This, in connexion with Stutchbury's discovery of a living *Trigonia* at Port Jackson, and other evidences of mesozoic life at the Antipodes, noticed in the published descriptions of the fossil marsupials of British oolites, is an interesting fact. Faithfully yours,

British Museum, May 19, 1862.

RICHARD OWEN.

On the Development of Actinotrocha branchiata.

By Dr. A. SCHNEIDER.

Krohn first discovered that *Actinotrocha* is the larva of a Sipunculide (Müller's 'Archiv,' 1858, p. 293). In his investigations, however, the passage into the worm took place so rapidly that he could obtain only a very imperfect notion of the nature of the metamorphosis. At the time when I was engaged in Heligoland with investigations upon the same subject, Claparède published (in Reichert and Dubois's Archiv, 1861, p. 538, taf. 2. figs. 1–6) the exact description of a Sipunculide, which, as Claparède himself asserts, was not fully developed. I believe I may assume with tolerable certainty that this is derived from an *Actinotrocha*. Krohn's discovery was made upon a new species. I succeeded with *Actinotrocha branchiata*, not only in ascertaining the Sipunculide to which it belongs, but also in tracing the evolution step by step.

In the cavity of the body of *Actinotrocha* there is a long convo-

luted tube, which is closed at one end, and at the other opens externally on the ventral surface. This tube is the body-wall of the future worm. By becoming turned inside out it issues from the body, at the same time taking in the intestine of the larva completely.

This process, considered in detail, is as follows:—The tube is swelled at its closed end into the form of an acorn. A little before this inflation, its outermost layer (the innermost layer of the perfect worm) is firmly attached to the wall of the intestine of the *Actinotrocha*, at the spot where the stomach or middle part of the intestine passes into the rectum or terminal part of the intestine. In the meanwhile the vascular system of the worm is already formed. A narrow double streak, which runs along the dorsal surface of the stomach and œsophagus, is the foundation of the two longitudinal vessels. At the spot above mentioned, at the commencement of the rectum, numerous cæca sprout forth. These are the cæcal diverticula, which, in the perfect worm, stand upon the posterior loop of the vessels. Although there is not yet any circulation of blood, these portions of the vascular system, and especially the cæca, are already in jerking motion. The anterior annular vessel, as also the blood-corpuscles, are produced from two aggregations of cells of a blood-red colour, which stand on each side of the anterior extremity of the tube. After these preparations, the tube turns itself out, in the manner of the tentacle of a Snail. As the intestine is attached to it, this is drawn out with it, like a loop of intestine in hernia. The entire body-wall of the larva disappears, with the exception of the tentacles, which, now contracted into a close circlet, close the anterior extremity of the tube. The oral lobe and rotatory organ have completely disappeared. The mouth and anus remain the same, except that now they are brought quite close together, both standing at the anterior end on opposite sides. However, all the tentacles of the larva are not transferred into the worm. Towards the close of the larval life, a second circlet of tentacles sprouts forth at the base of and behind the first circlet of tentacles. Only the second remains; the first falls off.

The entire surface is ciliated, with the exception of the hindmost acorn-shaped end. As far as the ciliation extends, a transparent tubular sheath surrounds the body. The free posterior extremity, which is set with small warts, serves the animal for attaching itself. The blood now circulates briskly: it streams forward through one vessel, enters the tentacles, and flows back through the other vessel. At the posterior end the two vessels are united by the above-mentioned loop, beset with contractile cæca.

The worm has not yet, however, attained its definitive form. The tentacles, together with the portion of the skin on which they are seated (the last-remaining portion of the body-wall of the *Actinotrocha*), are thrown off in a coherent piece, as in a moulting. By this means the anterior extremity acquires a button-like form. The circulation continues, but the vessels now pass into each other in a simple loop at the anterior end. The further development of the worm could not be traced.—*Monatsber. der Akad. der Wiss. zu Berlin*, October 1861, p. 934.

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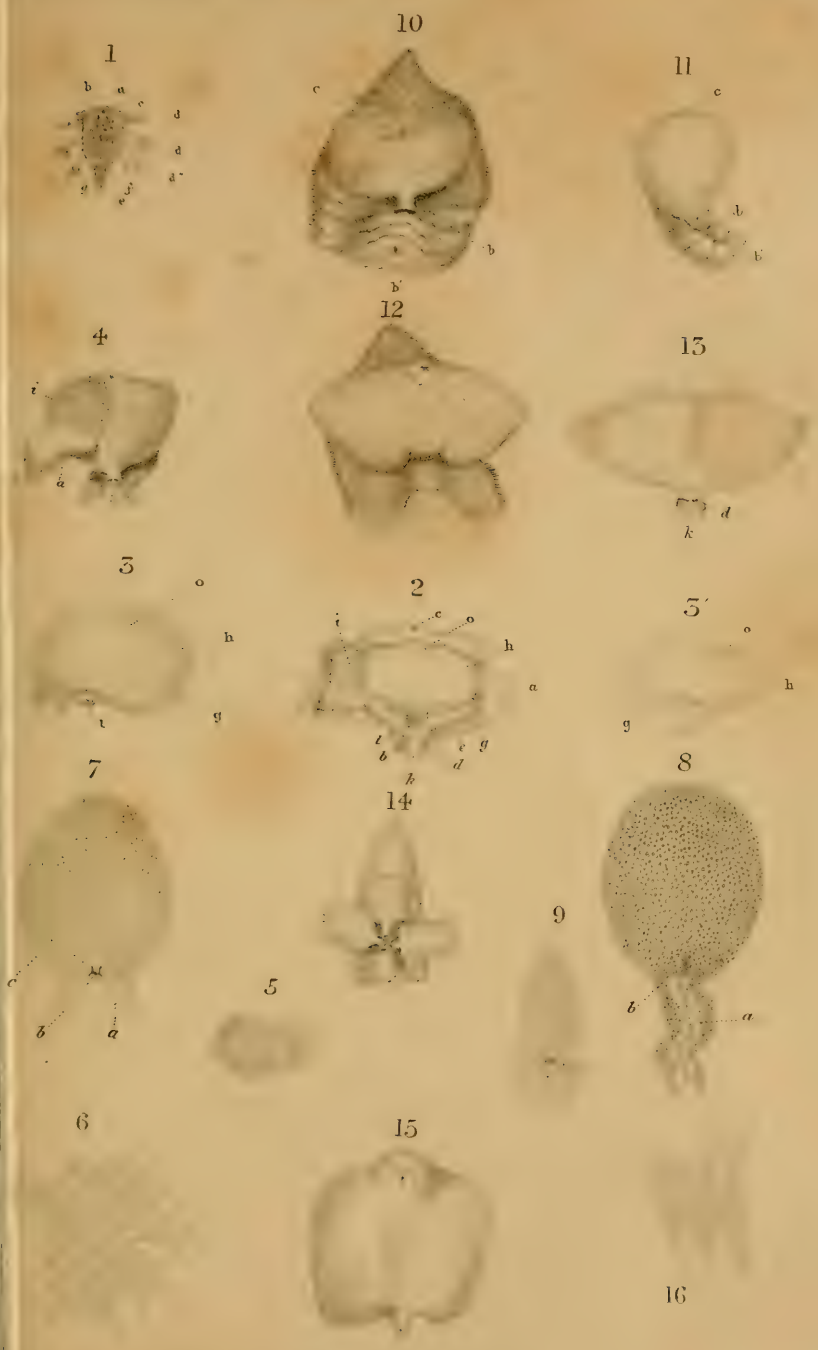
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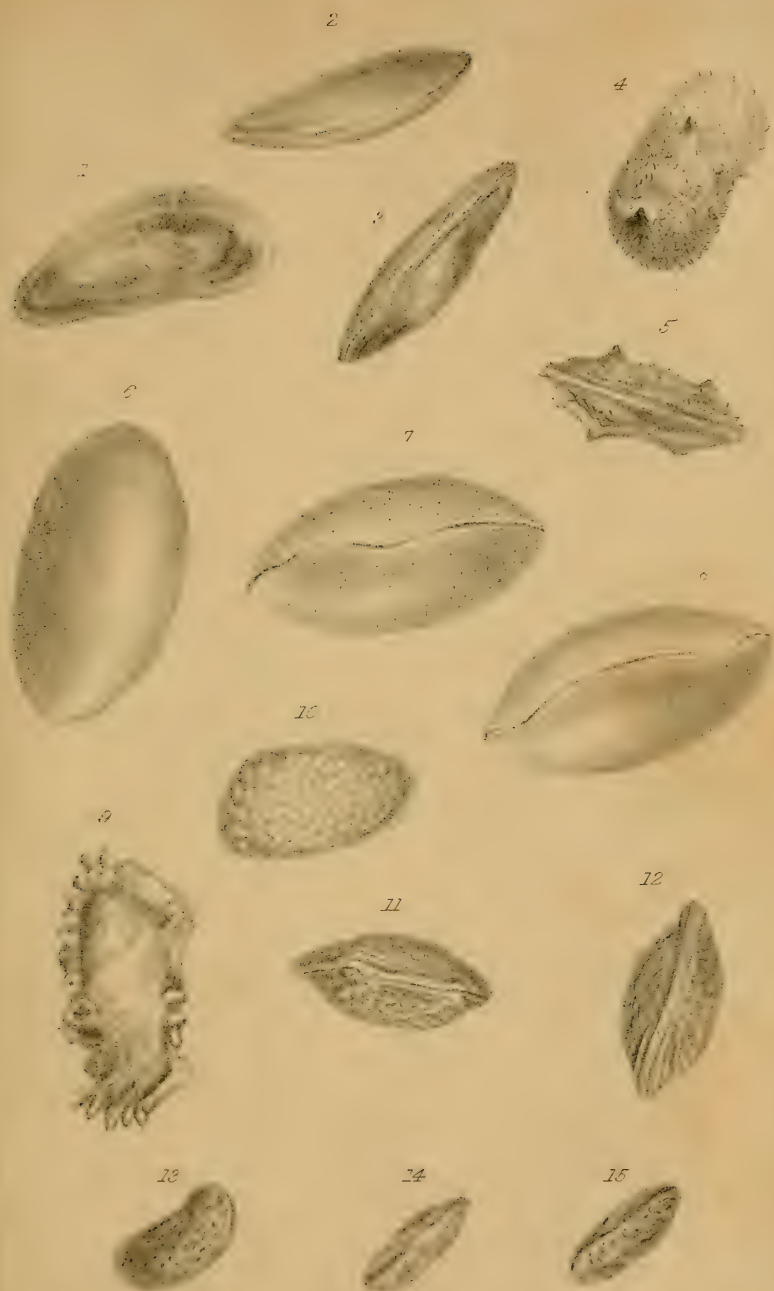
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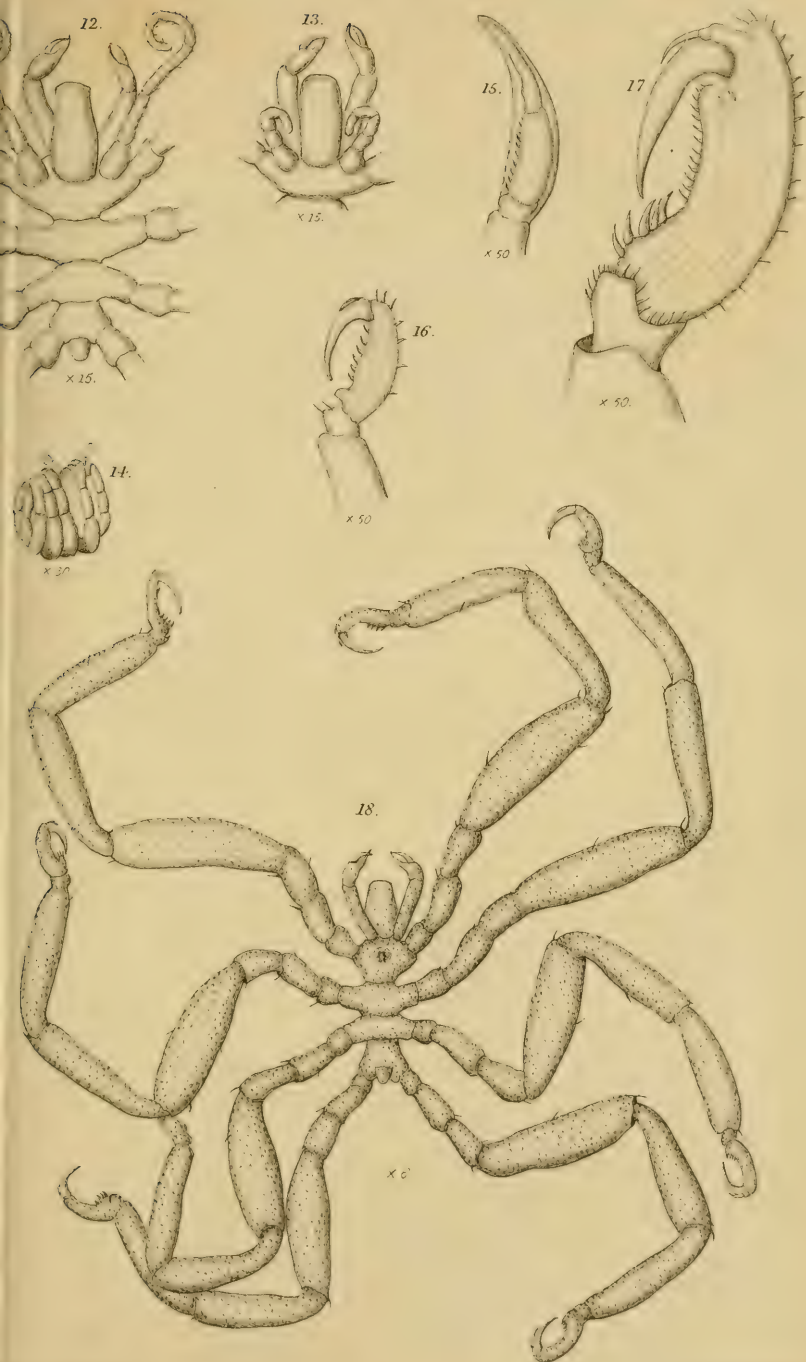
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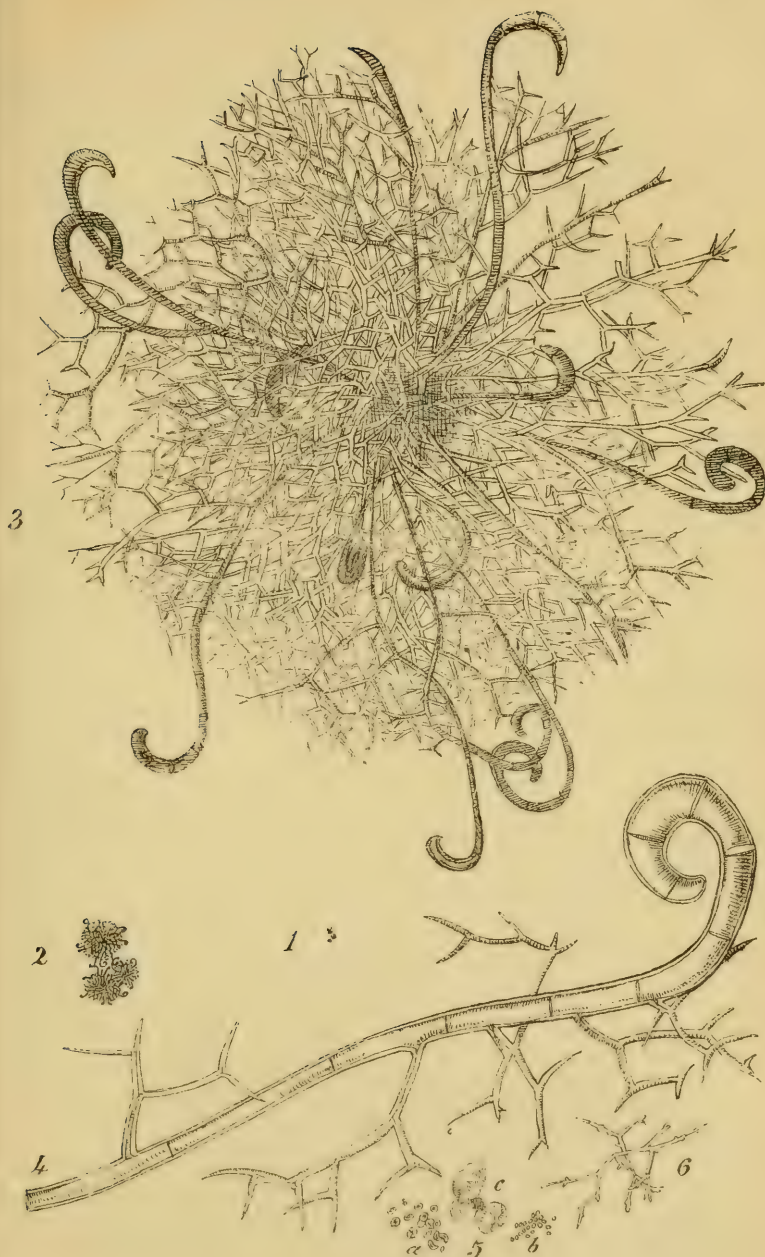




Fig. 3.



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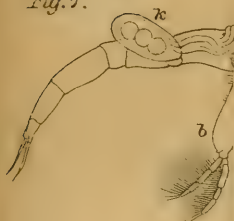


Fig. 11.



Fig. 1



Fig. 3.

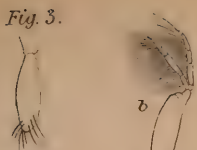


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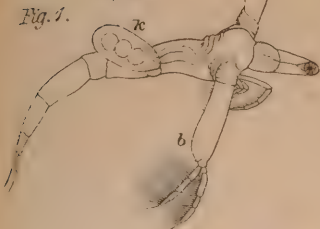


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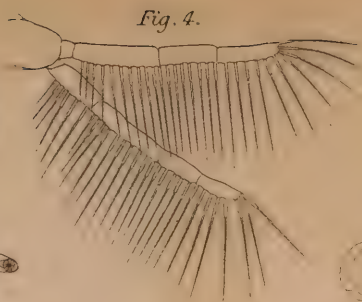


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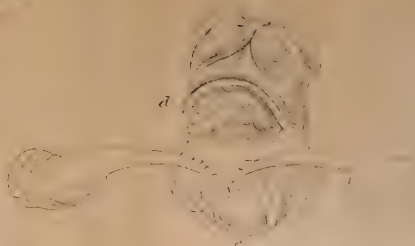


Fig. 2.

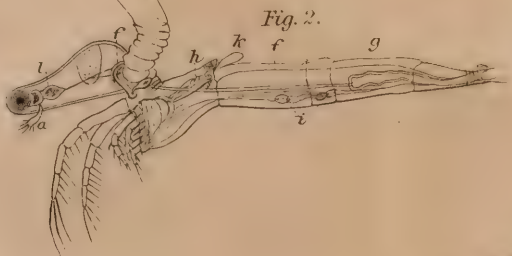


Fig. 5.



Fig. 11.



Fig. 9.

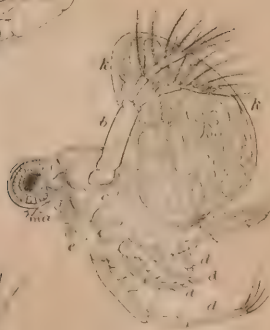


Fig. 7.



Fig. 10.

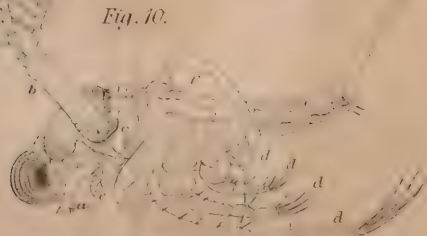
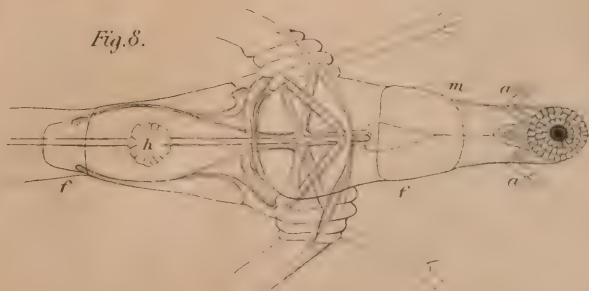
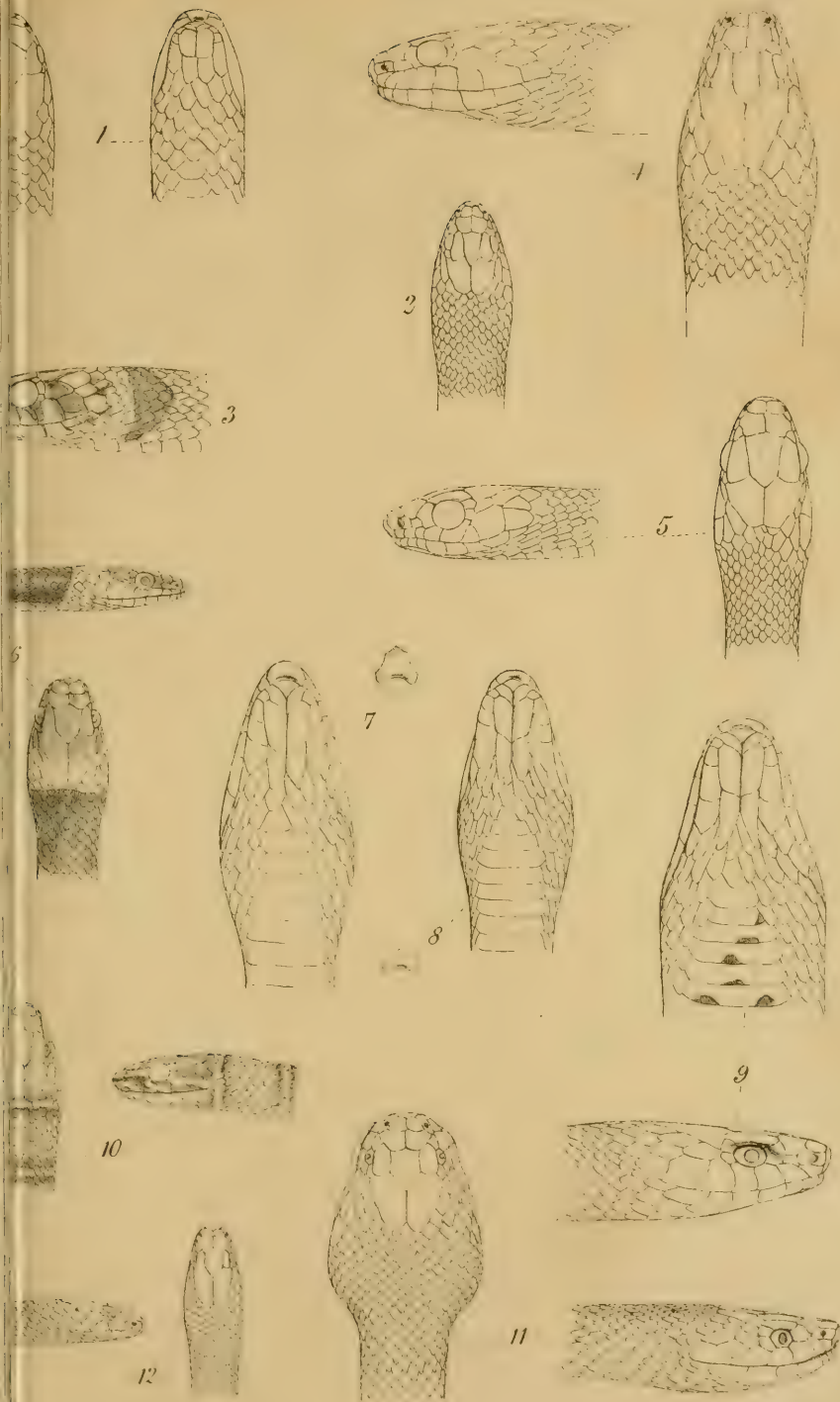
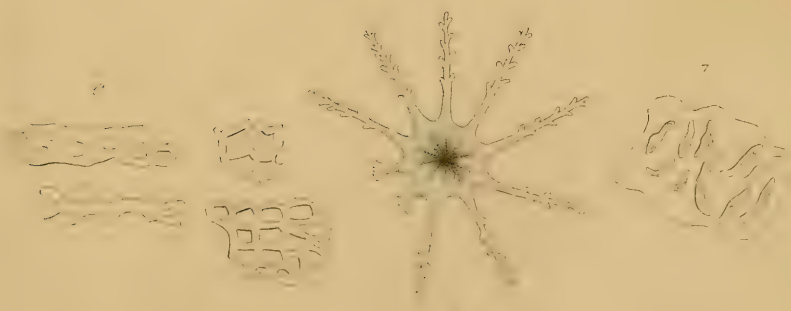
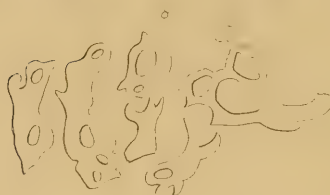


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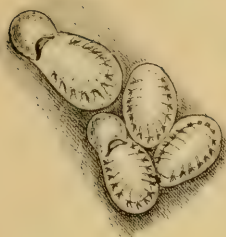








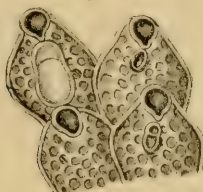
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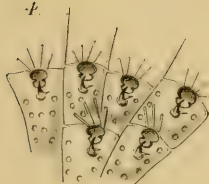
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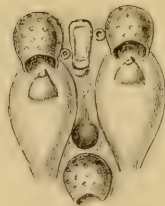
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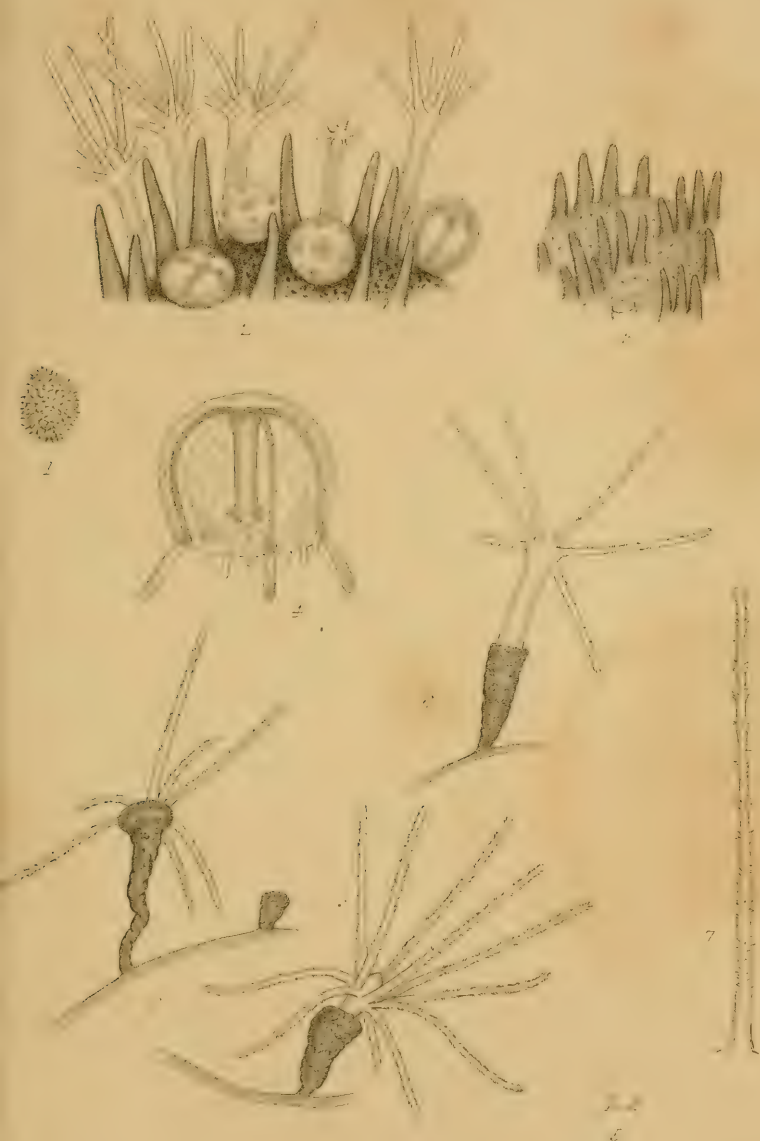


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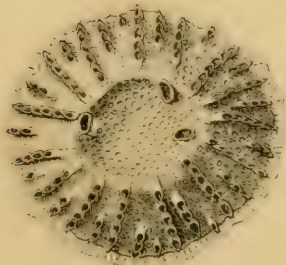






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